April 1954

MECHANICAL ENGINEERING

Management With Automatic Production . . . *C. E. Knight* 317

Using Optical Measurements in Engineering . *N. A. Finkelstein* 321

Relating Sawmill "Waste" to Log Quality . . *F. C. Simmons* 327

Die Engineering . . . . . *E. A. Reed* 331

Report on Progress in Railway Mechanical Engineering—1952-1953 (*Concluded*) 334

New Extrusion Techniques Developed . . . . . *H. Albers, G. Krause, and A. Greensite* 343

Departments

Briefing the Record, 346
European Survey, 358
ASME Technical Digest, 360
ASME News, 380
New Catalogs Guide, Adv. Page 41

ASME Semi-Annual Meeting, Pittsburgh, Pa., June 20-24, 1954

IT WAS A LONG MEETING
–and all we talked about was ash

Yes, gentlemen, we know what you mean. Ash from burning coal is on the agenda of many meetings today —meetings of industrial and utility power-plant operators, air-pollution control boards, and civic-minded groups.

And when you're running a big power plant whose boilers consume many tons of coal every hour, ash disposal becomes a serious problem for discussion. You must talk about the high cost of equipment to trap fly-ash before it leaves the stack . . . the expense of paying for carting away tons and tons of this waste . . . and, of course, how to get the most out of the coals you buy, even if their ash content is high.

These and related problems have plagued industrial and utility power-plant men for years, the more so because they have a keen sense of responsibility for keeping their cities clean, and they are determined to keep operating costs down not only in their own interest but also that of the public.

We would like to make a suggestion. Put B&W's Cyclone Furnace on the agenda for your next meeting . . . and the day you put the Cyclone on your firing aisle you'll start enjoying advantages more and more power-plant men are discussing.

This more efficient method of burning coal converts most of the ash to molten slag, which drains continuously into a water pit for disposal.

If need be, the small amount of fly-ash remaining in the stack gases can be trapped by simple, inexpensive ash collectors and then returned to the Cyclone Furnace to be melted into slag. Result: Elimination of air pollution and of the costly mess of fly-ash disposal.

The Cyclone has many other advantages of interest—increased combustion efficiency, greater fuel flexibility, increased safety, and easier operation.

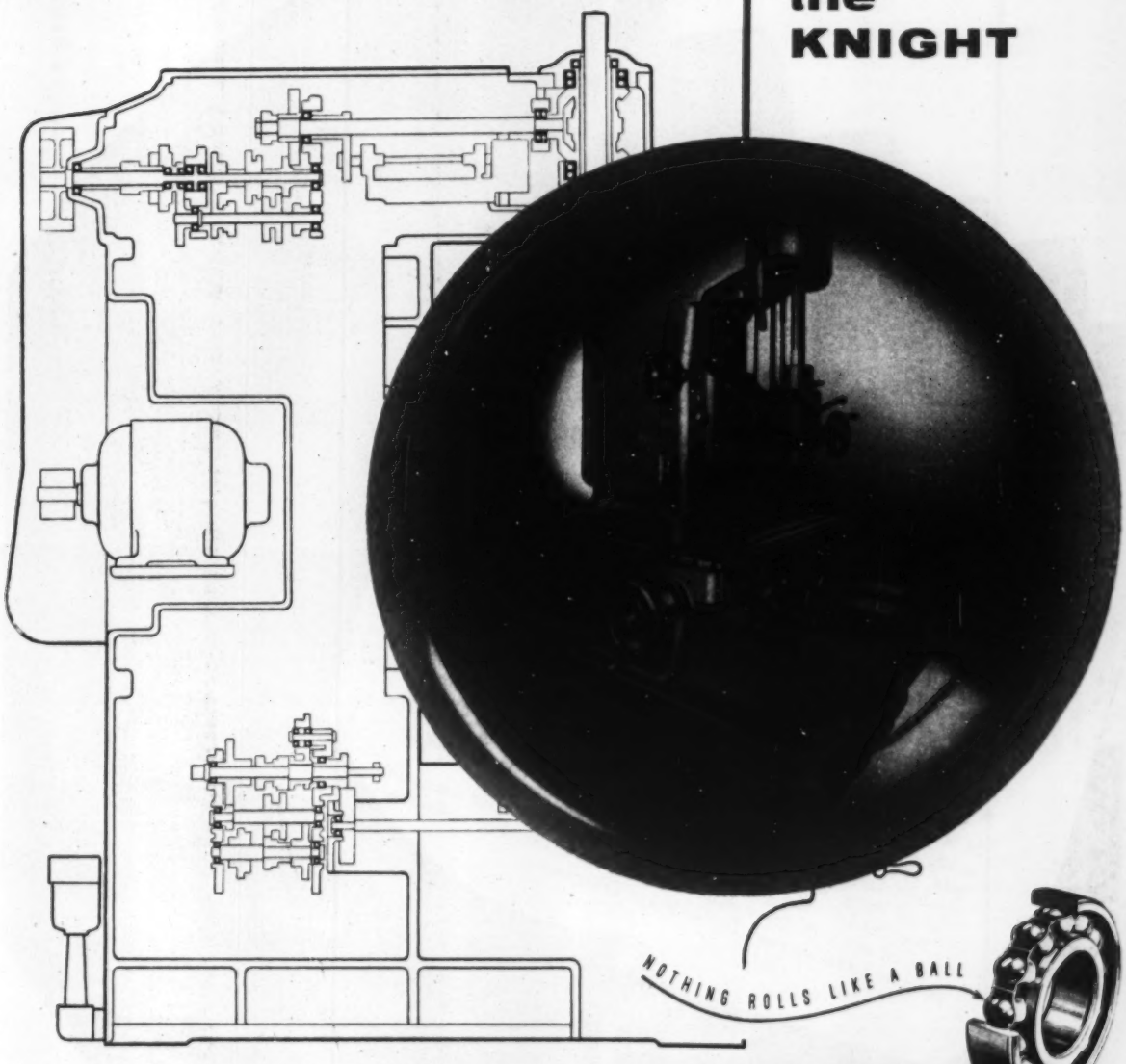
All this is accomplished—and is being proved in daily service—with *less equipment, less building volume, less manual labor,* and *less maintenance* than is possible when pulverized coal is used. For the Cyclone Furnace is a vast simplification of the entire process of coal preparation, combustion, ash segregation, and ash handling, which brings important savings right down the line.

Selected to fire some of the world's largest and most efficient boilers, Cyclone Furnaces are in operation—under a variety of operating conditions—in different parts of the country. Based on this intensive, long-range experience, we will be pleased to discuss the advantages which the Cyclone Furnace offers.

BABCOCK & WILCOX
BOILER DIVISION

N-166

NEW DEPARTURES AT WORK all through the KNIGHT



Combining great capacity with exceptional accuracy, W. B. Knight's No. 50 is a versatile milling and boring machine. New Departure **ball** bearing applications are found literally throughout the Knight. They assure rigid support of moving parts . . . maintain accurate pitch-line contact of gears . . . give longer life with minimum maintenance.

New Departure **ball** bearings offer operating advantages to *your* product. Call in your New Departure engineer . . . find how **ball** bearings make a good product even better.

NEW DEPARTURE
BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT
Plants also in Meriden, Connecticut and Sandusky, Ohio
In Canada: McKinnon Industries, Ltd., St. Catharines, Ontario

NEW DEPARTURE SALES ENGINEERING OFFICES—AT YOUR SERVICE

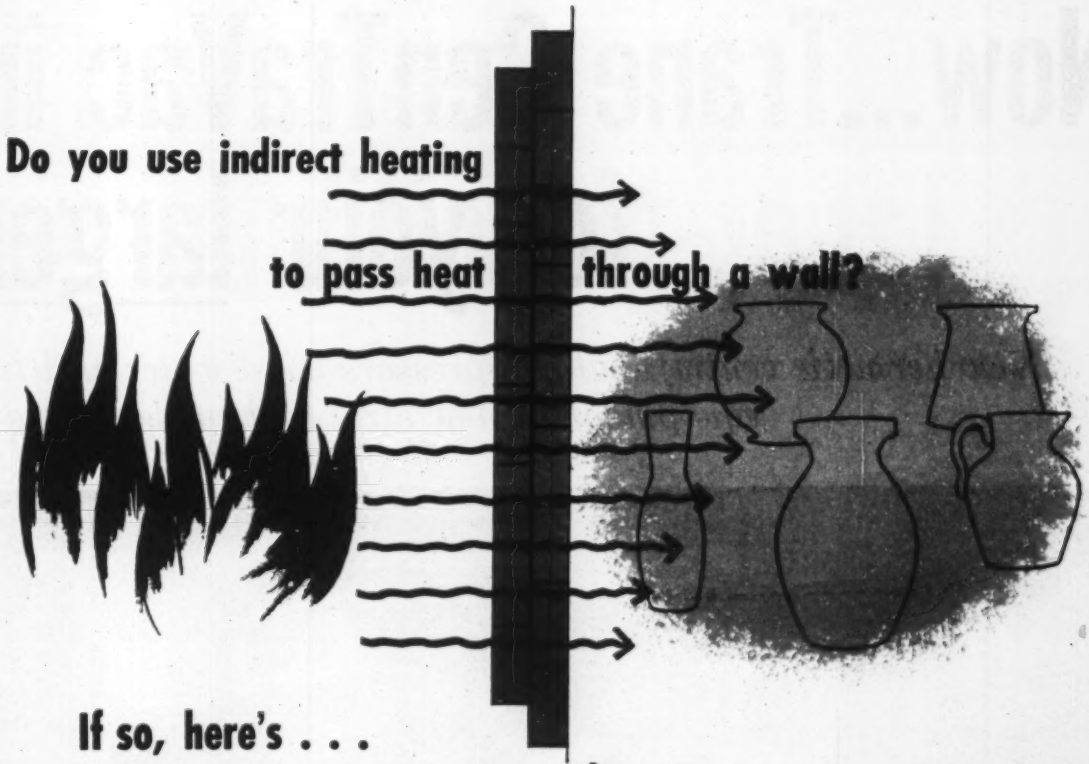
BRISTOL	269 North Main St.	2-6371	**DETROIT**	7-122 General Motors Bldg.	Trinity 2-4700	**KANSAS CITY**	1021 E. Linwood Blvd.	Valentine 4939
BOSTON	517-A Park Square Bldg.	Hancock 6-9867	**CINCINNATI**	2107 Carew Tower	Main 5783	**MILWAUKEE**	647 W. Virginia St.,	Broadway 6-9460
KANNAPOLIS, N. C.	P. O. Box 1086	2-3181	**CLEVELAND**	3113 W. 110th St.	Winston 1-5454	**ST. LOUIS**	3001 Washington Blvd.	Franklin 6533
NEW YORK	1775 Broadway	Circle 6-1540	**INDIANAPOLIS**	1357 W. 18th St.	Imperial 4680	**LOS ANGELES**	5035 Gifford Ave.	Logan 8-2301
PHILADELPHIA	850 E. Luzerne St.	Garfield 3-4136	**PITTSBURGH**	Cathedral Mansions	Mayflower 1-8100	**BERKELEY**	1716 Fourth St.	Landscape 6-8750
SYRACUSE	2360 James St.	73-5195	**CHICAGO**	332 So. Mich. Ave.	Wabash 2-5875	**SEATTLE**	5000 First Ave., S.	Lander 5920
			DAVENPORT	2212 E. 12th St.	Davenport 7-7522			

MECHANICAL ENGINEERING, April, 1954, Vol. 76, No. 4. Published monthly by The American Society of Mechanical Engineers, at 20th and Northampton Sts., Easton, Pa. Editorial and Advertising departments, 29 West 39th St., New York 18, N. Y. Price to members and affiliates one year $3.50, single copy 50¢; to nonmembers one year $7.00, single copy 75¢. Postage to Canada, 75¢ additional, to foreign countries $1.50 additional. Entered as second-class matter December 21, 1920, at the Post Office at Easton, Pa., under the Act of March 3, 1879. Member of the Audit Bureau of Circulations.

There is a difference in return bends—
Making a seamless return bend is no simple task. Holding it to the unvarying accuracy and metallurgical uniformity found in 180° WeldELLS® is a feat that could be accomplished only by the organization that pioneered the seamless return bend and perfected it through a quarter century of specialization.
Every WeldELL return bend gives you exactly what you ordered: true roundness, accurate size, full pipe thickness from end to end . . . controlled quality all the way through. No fitting tells the WeldELL story better than the return bend. There IS a difference!
And there IS a difference in all Taylor Forge Welding Fittings. It is a difference that is particularly important now that fittings made to low standards have come into the market. Today the best way to be sure you are getting welding fittings of highest quality, conforming to all codes and standards, is to specify Taylor Forge WeldELLS.
WeldELLS—the first complete line—is still the most complete line, in range of types, sizes, weights, materials. For up-to-the-minute facts see your Taylor Forge Distributor.
TF

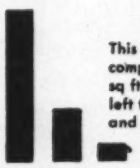
TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS, General Offices and Works: P.O. Box 485, Chicago 90, Ill.
Offices in all principal cities. Plants at: Carnegie, Pa.; Fontana, Calif.; Gary, Ind.; Hamilton, Ont., Canada



If so, here's . . .

A refractory that's "heat-transparent"



This is how three commonly used refractories compare in thermal conductivity, (BTU/hr, sq ft and °F/in. of thickness at 2200 F). From left to right: silicon carbide, aluminum oxide, and fireclay.

While you ordinarily think of a refractory as a heat-*containing* material, CARBORUNDUM's silicon carbide is anything but. It actually transmits heat *11 times faster* than fireclay. Practically as fast as the high temperature alloys!

This property is silicon carbide's greatest asset. It makes it ideal for retorts, muffles, and hearths . . . or wherever you pass heat through a wall. Take one case: When used to replace the fireclay arch of a Mannhiem furnace, output was doubled—and the fuel input ratio was cut 50%! And that's not an exaggerated example.

This same property enables silicon carbide to absorb and release *up to five times as many BTU's* per second as fireclay. It's ideal for checkers, recuperators, and other heat-exchange equipment. On the other hand, it's equally good where heat has to be dissipated (e.g. arc shields, pot settings, etc.)

But the clinching advantages are that it has a tested crushing strength of over 10,000 psi at 2500 F . . . is safe to use up to 3000 F . . . withstands abrasive/erosive wear-and-tear far better than metals . . . is inert to acid attack . . . and, in general, outlasts other materials, even under the most destructive conditions known.

In fact, this ability to withstand extreme conditions distinguishes *all* CARBORUNDUM's super refractories (including one of the best *insulating* materials for high temperature work). These range all the way from a cotton-like ceramic fiber to super-dense refractories that are cast like metals. So whether you need to conduct heat, or contain it, CARBORUNDUM's "man-made minerals" offer unusual possibilities. We'd like to explore their interesting features with you.

CARBORUNDUM
Registered Trade Mark

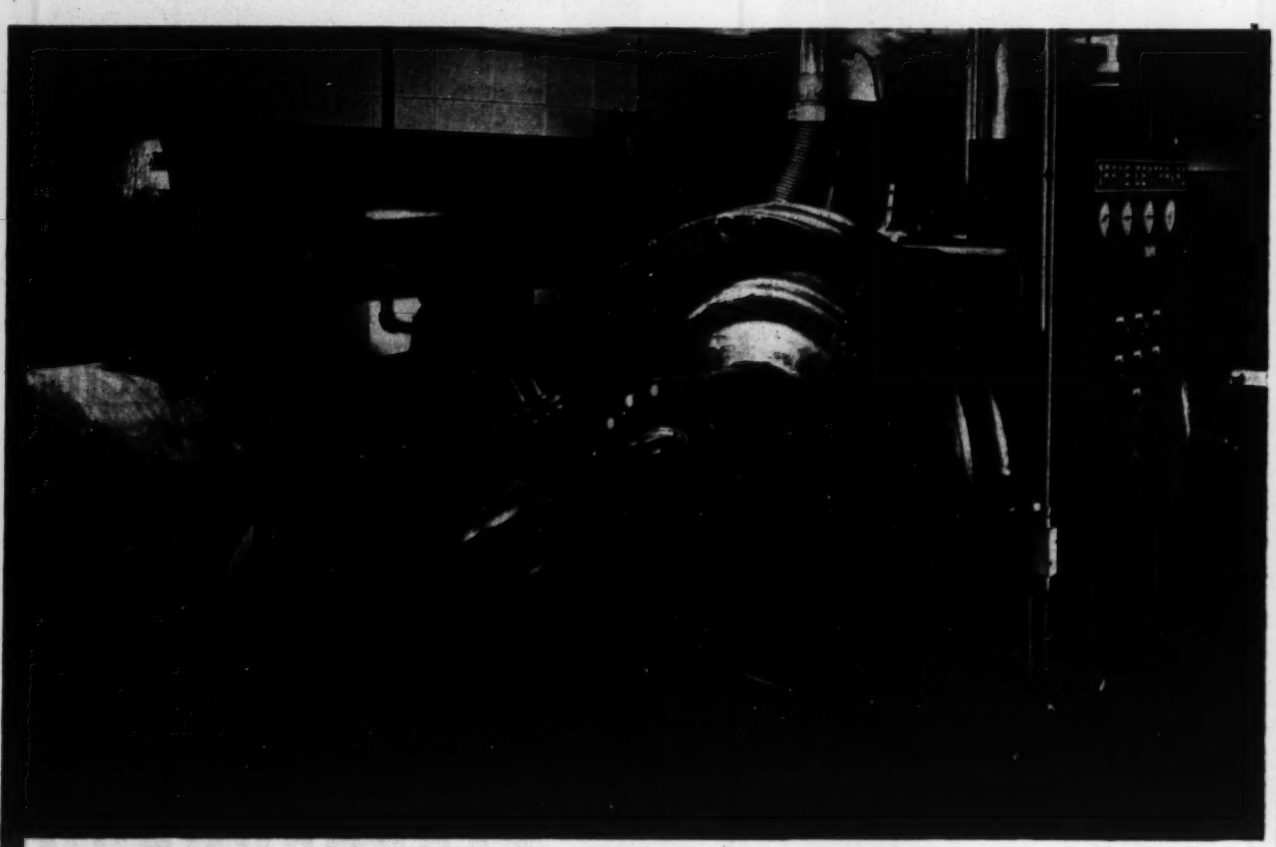
Dept. Y-44, Refractories Division
The Carborundum Co., Perth Amboy, N. J.

☐ As a starter, send literature only.
☐ I'd like first-hand information. Please phone for appointment.

Name _____ Position _____
Company _____
Address _____

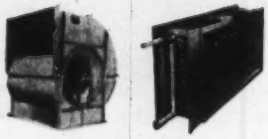
Now...Trane CenTraVac in for your larger

New hermetic centrifugal compressors boost water chilling equipment in new sizes and types provides

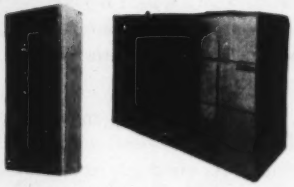


Trane Evaporative Condenser. Use where water is scarce or expensive. Cuts water consumption as much as 90%.

Trane Multi-Zone Climate Changer. Air conditions up to 6 zones at once — each zone can have different conditions. 450 to 23,400 cfm.



Trane Fans and Coils. Fans, Class I and II, backwardly inclined or forward curved. Coils for steam, hot water, cold water or direct expansion refrigerants.

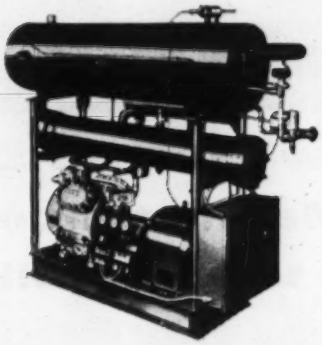


Trane Self-Contained Units. 3 to 20 tons. Heating coil optional. Built-in evaporative condenser optional with 10, 15, 20-ton units.

3 new sizes air conditioning jobs!

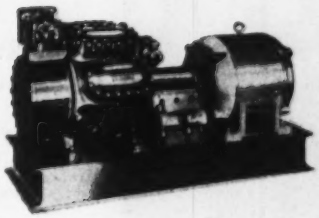
capacity up to 400 tons . . . Other Trane air conditioning increased design flexibility

CenTraVac Water Chiller in 3 new sizes tops the list of TRANE air conditioning equipment that has been widened again to enable you to design more efficiently, more economically than ever! CenTraVac single-unit capacities now range from 45 to a maximum of 400 tons. Hermetic centrifugal refrigeration unit completely self-contained. Starts, stops, modulates automatically. Lets you design systems that adjust automatically to varying cooling needs with power savings almost directly proportional to load variations. Requires no special bases.



4 New Cold Generator sizes—30, 60, 75 and 100 tons—expanded line now provides water chilling capacities from 10 to 100 tons. Complete refrigeration cycle . . . factory engineered, assembled, tested, guaranteed. A single unit, wired, piped and refrigerant-charged. Includes condenser, refrigerant piping, liquid cooler, control valves, motor and accessories. Only simple plumbing and electrical hook-up required.

3 New Reciprocating Compressor units—60, 75 and 100 tons—extend the line from 10 to 100 tons. TRANE compressors are smoother, quieter, longer-lasting. Maximum performance in minimum space. Direct drive. Factory-assembled. Easy to install. Automatically modulate capacity to match variations in cooling demand, slash power consumption. Available with shell-and-tube condenser.



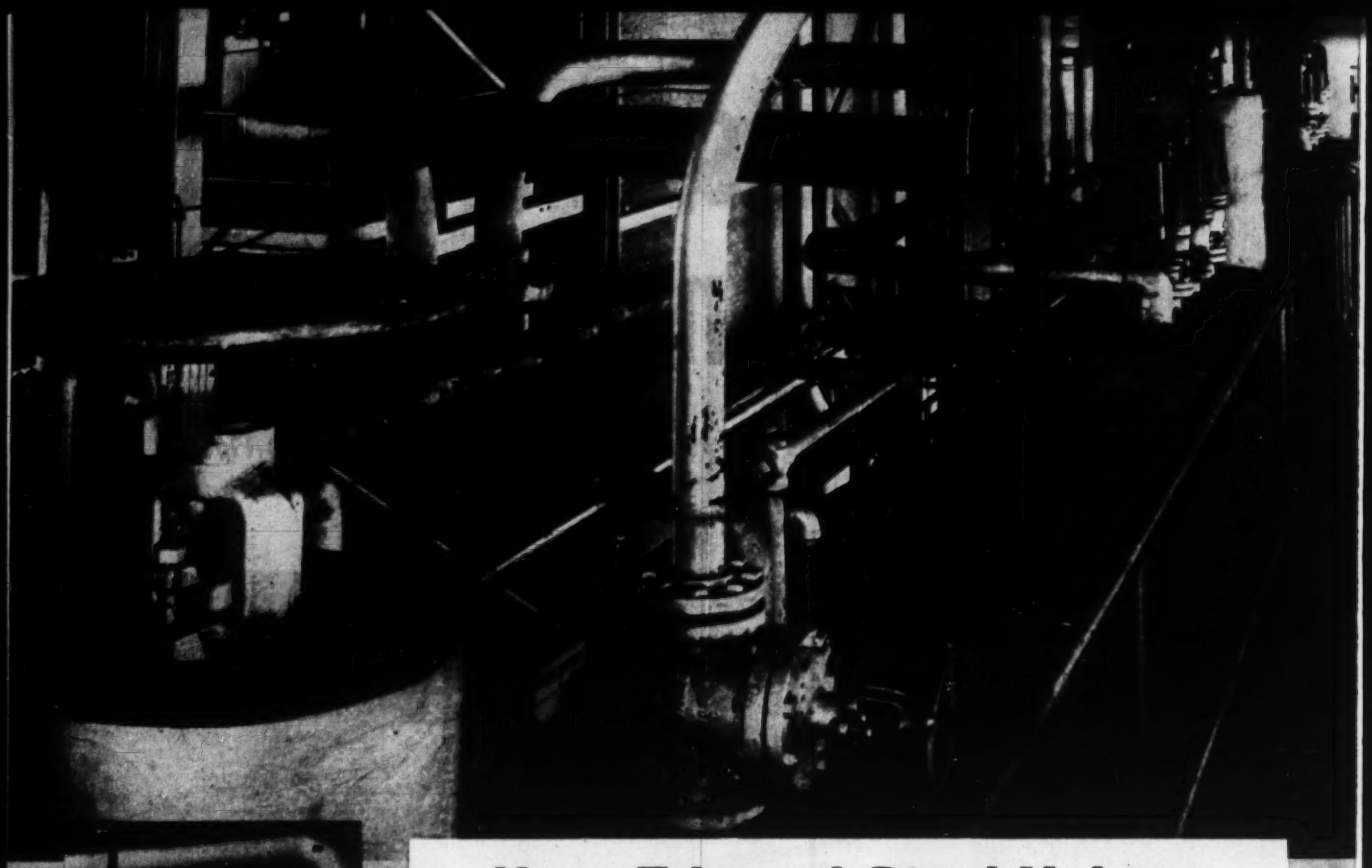
Trane UniTrane room units use chilled or hot water. Individual control. Free-standing, recessed or ceiling models.

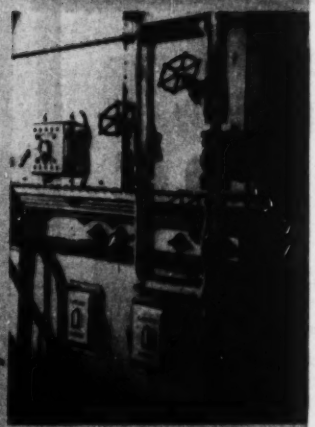
What kind of system are you planning? Large . . . small? Simple, complex? Cooling only or a complete air conditioning installation? Enjoy advantages of undivided responsibility and a single source of supply by specifying TRANE equipment. Before you plan your next job, get all the facts on complete TRANE line. Contact your TRANE Sales Engineer or write TRANE, La Crosse, Wis.

one source
one responsibility...
TRANE

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto
87 U.S. and 14 Canadian Offices.

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT





How Edward Steel Valves Cut Maintenance in a Hospital 150 lb sp Boiler Plant

RAY D. GANGWER, Chief Engineer, Gets Dependability, Saves on Replacements and Repairs with Steel Valves

Buying EDWARD 300 lb sp steel valves for 150 lb sp service proved a good investment at The Dr. Norman M. Beatty Memorial Hospital, Westville, Indiana.

Years ago, labor for repairing or replacing valves was relatively inexpensive. But, today, labor often costs more than the valve. So, for economy, the feedline, non-return, main steam distribution, blow-off and miscellaneous drain, gage and auxiliary valves in this steam generating plant are steel.

Maintenance personnel at the hospital like trouble-free Edward steel valves. Edward's dependability and low maintenance requirements more than justified their slight additional cost over the usual low pressure valves.

You, too, can cut your maintenance expense with low-cost Edward steel valves. Call the nearest Edward representative or contact Edward Valves, Inc., today.

The first of a series of case histories on the use of Edward steel valves in "under 300 lb sp" service.

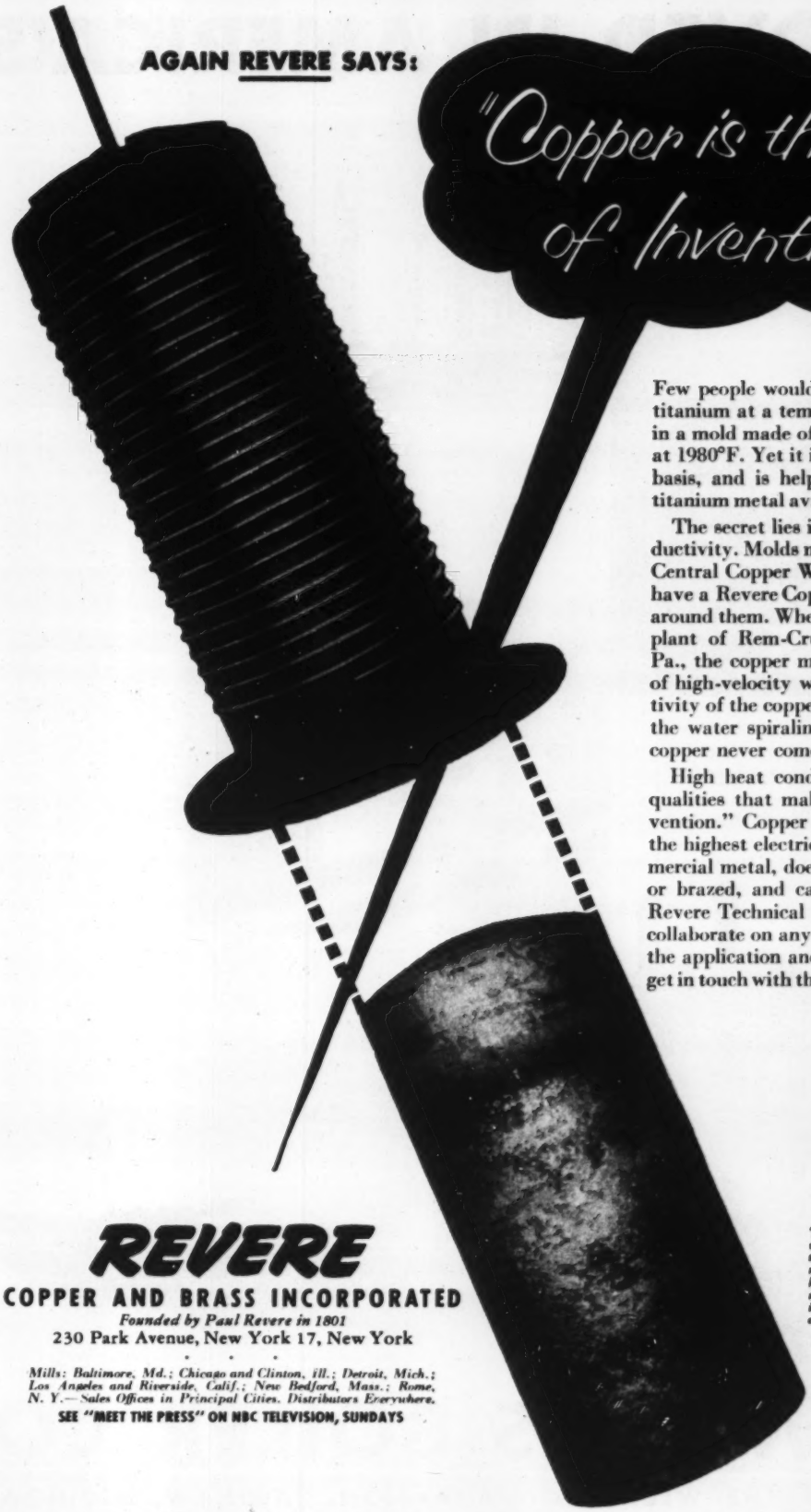
Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

1350 WEST 145th STREET
EAST CHICAGO, INDIANA

AGAIN REVERE SAYS:

"Copper is the metal of Invention!"



Few people would consider it possible to melt titanium at a temperature of 3140°F. or above in a mold made of copper, a metal which melts at 1980°F. Yet it is being done on a production basis, and is helping in the work of making titanium metal available on a commercial basis.

The secret lies in copper's high thermal conductivity. Molds made of Revere Copper by the Central Copper Works, Inc., Cincinnati, Ohio, have a Revere Copper baffle wrapped in a spiral around them. When installed in its jacket in the plant of Rem-Cru Titanium, Inc., Midland, Pa., the copper mold is connected to a source of high-velocity water. The high heat conductivity of the copper transfers heat so rapidly to the water spiraling along its surface that the copper never comes close to its melting point.

High heat conductivity is only one of the qualities that make copper "the metal of invention." Copper is also easily workable, has the highest electrical conductivity of any commercial metal, does not rust, is easily soldered or brazed, and can be welded perfectly. The Revere Technical Advisory Service will gladly collaborate on any special problems concerning the application and fabrication of copper. Just get in touch with the nearest Revere Sales Office.

Titanium ingot, 25" in diameter, 51" long, weighing 4,050 lbs., melted at 3140° F., and the water-cooled copper mold, which would melt at 1980°F. if it were not for copper's high heat conductivity. The flange on the mold is steel, welded to the copper by the inert gas shielded arc method, using silicon copper rod.

REVERE

COPPER AND BRASS INCORPORATED

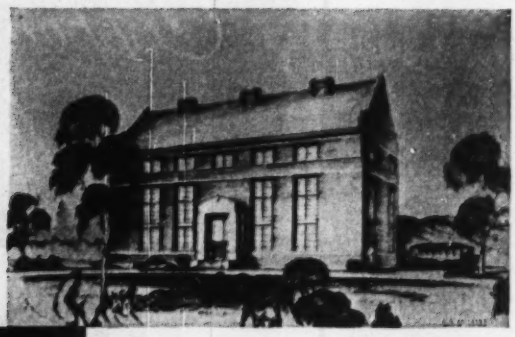
Founded by Paul Revere in 1801

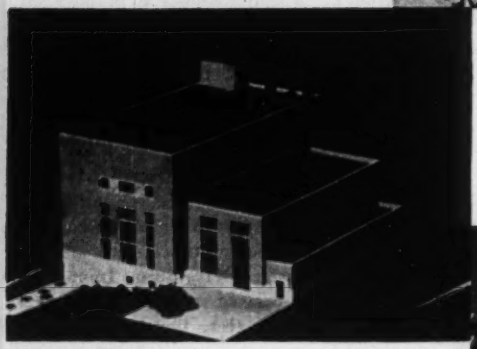
230 Park Avenue, New York 17, New York

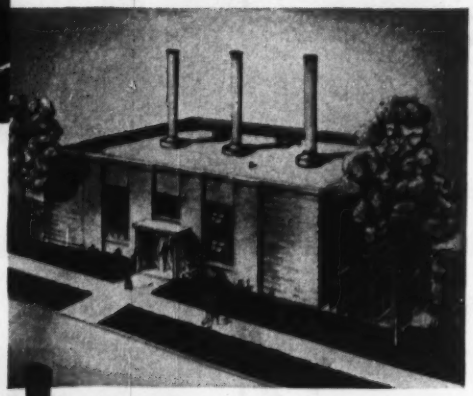
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities. Distributors Everywhere.

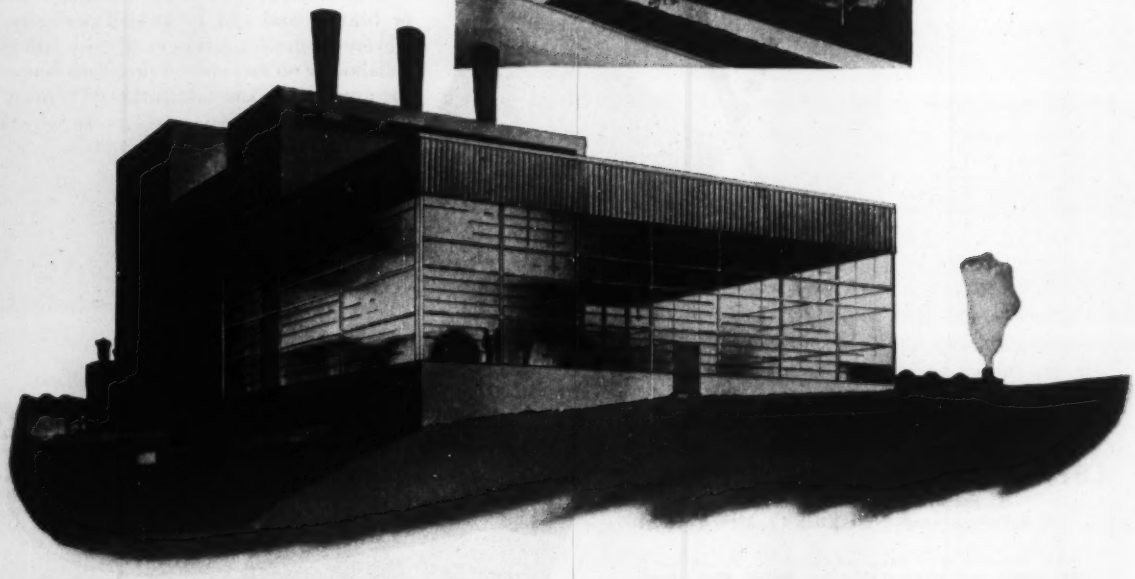
SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

PROVED IN AMERICA'S









THE WICKES BOILER CO.

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

POWERHOUSES SINCE 1854

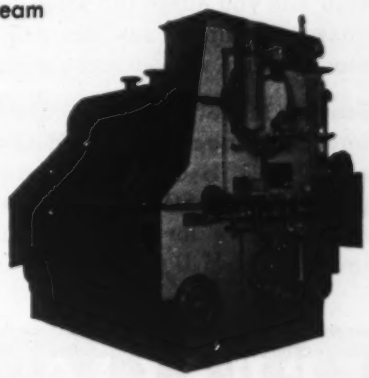
WICKES

STEAM GENERATORS

You'll find the real proof of WICKES' years of experience in the powerhouses across the nation . . . in the foundries and factories, the public utilities, the refineries and natural gasoline plants, in the schools, hospitals and other public buildings that depend on steam for low-cost heat and power. Wickes supplies steam generating equipment to thousands of industries and institutions.

WICKES will design and build water tube steam generators for any practical size and pressure. Wickes also offers a wide choice of auxiliary equipment so that it's possible for you to get not only the best steam generator but also the best correlated equipment.

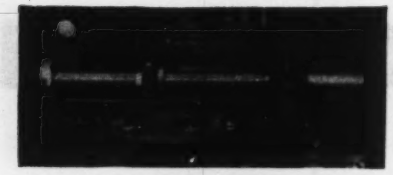
Contact your nearest Wickes sales representative or write us today.



183

RECOGNIZED QUALITY SINCE 1854 • **SALES OFFICES: Albuquerque, N. M. • Boston • Buffalo • Charlotte, N. C. • Chicago • Cleveland • Dallas • Denver • Detroit • Fort Wayne, Ind. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Portland, Ore. • Saginaw • Salt Lake City • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D. C.**

PROCESS CHANGES CAN'T OBSOLETE THIS TRANSMITTER . . .

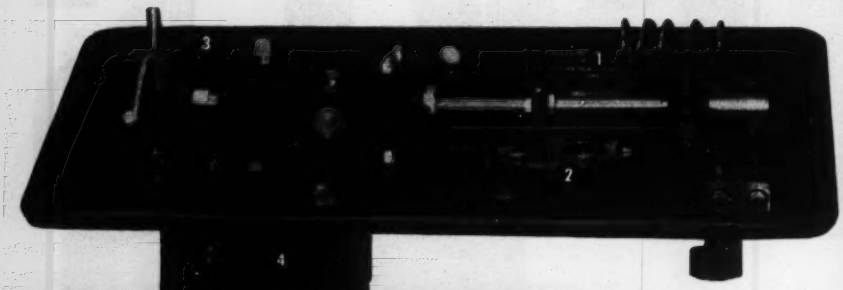


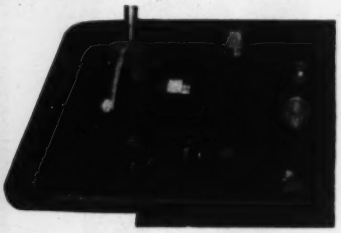
❶ 10-1 RANGE CHANGE —NO CHANGE OF PARTS

Double weighbeam construction on many models permits range changes as much as 10-1, just by turning a set of locking nuts to change a fulcrum point.

❷ ADDITIONAL 16-1 RANGE CHANGE—STILL NO PARTS CHANGE

Range may be changed on all models by loosening retaining bolts and sliding the reaction chamber to a new leverage position. Reaction area may be changed for further range change.





Process Model P-0331 with cover removed

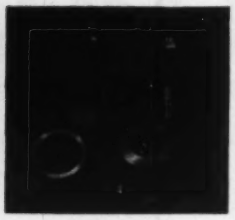
❸ SUPPRESS, COMPOUND OR REVERSE RANGES

Balancing spring, installed to exert either an upward or downward force on transmitter weighbeam, quickly converts transmitter for range suppressions up to 80% of total range, for reversed ranges or for compound ranges where pressure fluctuates above and below atmospheric pressure.

REPUBLIC PNEUMATIC TRANSMITTER

with

EASY RANGE CHANGE



❹ MAJOR RANGE CHANGES

Range change plates may be easily inserted or removed from measuring chamber to change the effective diaphragm area for major range changes. Similar plates may be used also in the reaction chamber for further range change.

Here's the pneumatic transmitter for measuring differential, flow, pressure or level that saves you time and money when operating conditions are not definitely known or processes are likely to be changed. Extreme flexibility of design lets you adapt the same transmitter chassis for almost any range of measurements—often without any change of parts.

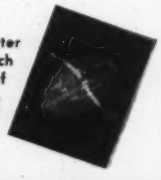
Process Model pictured above has a differential range of 0-12″ H_2O minimum and 0-880″ H_2O maximum at operating pressures to 1500 psig. Other models are available for differential ranges as low as 0-0.6 H_2O or as high as 0-750 psi.

Transmitters may be constructed of special materials to handle almost all types of corrosive fluids. Ruggedly built, they give long service out-of-doors. Accuracy is guaranteed at ½% of full range on standard models.

Republic transmitters are used in process, chemical and petroleum plants all over the country. Investigate their advantages for your plant.

FREE DATA BOOK

Get the full story about Republic transmitter flexibility. Send for free Data Book which gives all the facts about complete line of Republic transmitters, including Square Root Extracting and Pneumatic Electric models.



REPUBLIC FLOW METERS CO.

2240 Diversey Parkway, Chicago 47, Illinois

"Yes, we can quote on steel tube, too!"

"WHEN you get into production on that new product we were looking at, you'll be glad you specified Wolverine electric-welded steel tube. The combination of maximum rigidity, great strength, and lightness makes it a natural. It'll cut your costs to the bone."

"Well, if it's like other Wolverine products we've used . . ."

"It sure is! It's a product of Tubemanship like all the rest. Our steel tube is quality controlled from strip to finished product. It has uniform wall thicknesses and it's made to extra-close tolerances. You can fabricate it, join it, paint it, or get it with a surface suitable for plating. And we can deliver it in the exact lengths you need!"

"Does it meet SAE analyses?"

"Right down the line! You can get it in 1010, 1015, 1020, 1025, 1030,— and in sizes ranging from ¼" through 3" O.D. We make three types of steel tubing—condenser and heat exchanger, boiler, and mechanical. You'll need mechanical tube, of course, here."

It's dollars to doughnuts: Yes, it's a sure bet that Wolverine electric-welded steel tube can help you. And it's so easy to find out. Just write—explain your problem—and a Wolverine representative will call right away. If you'd like more information, you'll enjoy looking at our steel tube catalog. You can have one if you write—today! WOLVERINE TUBE DIVISION of Calumet & Hecla, Inc., 1483 Central Ave., Detroit 9, Mich.

WOLVERINE TUBE DIVISION
OF CALUMET & HECLA, INC.
Manufacturers of Quality-Controlled Tubing

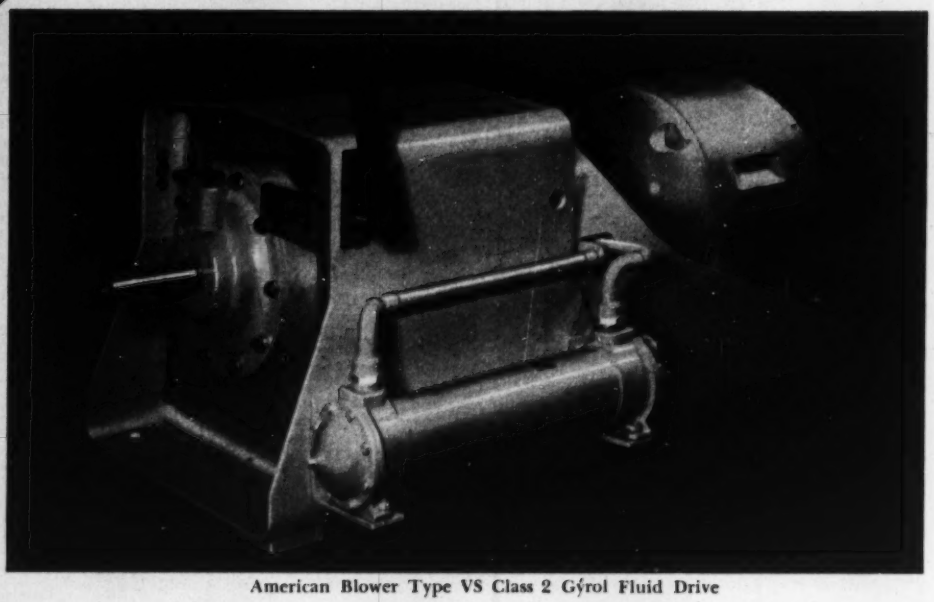
PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA • Sales Offices in Principal Cities

Export Dept., 13 E. 40th St., New York 16, N.Y.

ANNOUNCING THE NEW AMERICAN BLOWER

Gyrol FLUID DRIVE

TYPE VS CLASS 2



American Blower Type VS Class 2 Gyrol Fluid Drive

- **Can be reversed while in motion at any variable operating speed by merely reversing direction of rotation of motor**
- **Permits adjustable speed control over a wide range**
- **Built in several standard arrangements**

A phantom view of the driving and driven members, which provide smooth, reversible power transmission.

HERE IT IS! A brand-new fluid drive that will help you solve many tough industrial-drive problems. It's the American Blower Type VS Class 2 Gyrol Fluid Drive. A compact, self-contained, adjustable speed unit.

The result of years of development and research, this adjustable-speed fluid coupling is crammed with features. It has unlimited application possibilities, with its wide-range, stepless speed, reversible control. Even on constant-torque loads, a 4-to-1 speed range is obtainable!

It permits driving motors to reach full-load speed before engaging the load. In many cases simple across-the-line starting may be used. Adjustable speed may be obtained by either automatic or manual adjustment of the speed-control lever.

The new Type VS Class 2 Gyrol Fluid Drive is available in six sizes . . . 7½ through 800 h.p., at normal motor speeds up to 1800 r.p.m. Built in five standard arrangements, it can be used on a wide variety of industrial applications.

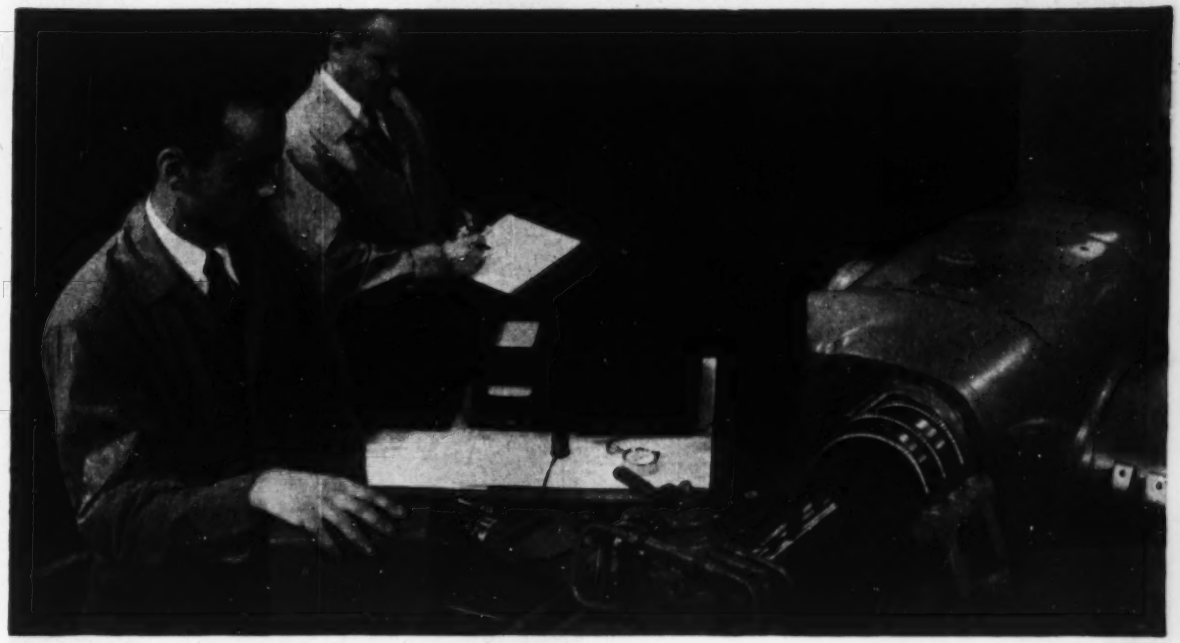
For complete information about the Class 2 Gyrol Fluid Drive, give your nearest American Blower Branch Office a call, or write us for Bulletin 9419.

For smaller applications the Type TM Constant Speed Gyrol Fluid Drive is available in ratings from 1 to 20 h.p.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

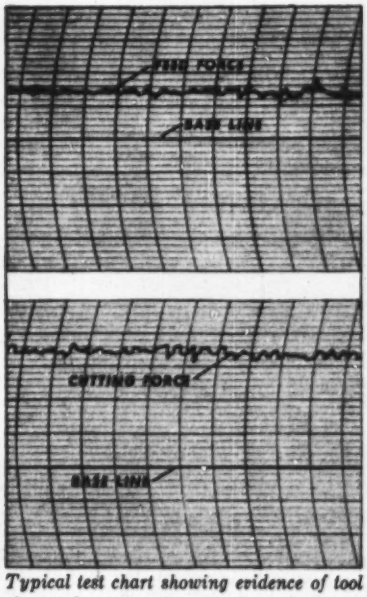
AMERICAN BLOWER

Serving home and industry: **AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS**



How Brush Analyzers help you

INCREASE MACHINING SPEEDS



Typical test chart showing evidence of tool chatter due to an improperly ground tool.

Before setting up machine tools for long production runs, Monarch Machine Tool Company, Sidney, Ohio, recommends this simple preliminary test—which permits using the fastest machining speeds consistent with satisfactory tool life.

A strain-gage type dynamometer toolpost is mounted on the lathe to measure cutting force and feed force. As test materials are then machined, a Brush Analyzer immediately records the forces. Using the charts—which eliminate laborious plotting of data—engineers can quickly spot any chatter, vibration, or unusual tool wear. The optimum cutting speeds, feeds, and depths of cut can thus be easily determined for each specific job and material.

Versatile Brush Analyzers save time and simplify analysis in many applications. You can use them to record stress, strain, force, torque, vibration, pressure, and other mechanical or electrical characteristics. These precision instruments give you immediate answers in writing. For help on your measurement problems or for latest literature, call your nearby Brush representative—or write Brush Electronics Company, Dept. P-4, 3405 Perkins Avenue, Cleveland 14, Ohio. In Canada: A. C. Wickman, Ltd., Toronto.

BRUSH ELECTRONICS COMPANY

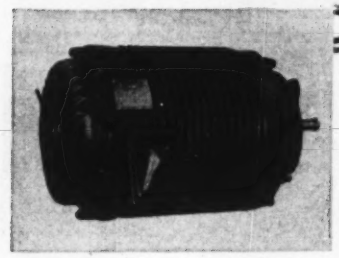
INDUSTRIAL AND RESEARCH INSTRUMENTS
PIEZO-ELECTRIC MATERIALS • ACOUSTIC DEVICES
MAGNETIC RECORDING EQUIPMENT
ULTRASONIC EQUIPMENT

formerly
The Brush Development Co.
Brush Electronics Company
is an operating unit of
Clevite Corporation.

TO MAKE A NEW PRODUCT POSSIBLE,
OR AN OLD PRODUCT BETTER
American Felt
Research
American makes felt that is soft as a kitten's ear, or hard as a board, and many kinds in between; felt of pure wool, or blends of wool with natural and synthetic fibres, or all synthetic; oil seals of felt layered with synthetic rubber, and so on. Because there are many hundreds of different types, it is important for manufacturers to choose correctly among them.
For example, recently a company had developed a new machine. The final important item was the felt to be used. Various selections were tried, and failed. Finally, the problem was put up to us, and promptly solved, making it possible to start producing the new device. If the company had come to us earlier, much time would have been saved.
It will pay you to make sure about felt. American's Engineering and Research Laboratory is at your service. Won't you let us collaborate with you?
American Felt Company
TRADE MARK
GENERAL OFFICES:
50 GLENVILLE ROAD, GLENVILLE, CONN.
SALES OFFICES: New York, Boston, Chicago, Detroit, Cleveland, Rochester, Philadelphia, St. Louis, Atlanta, Dallas, San Francisco, Los Angeles, Portland, Seattle, San Diego, Montreal. — PLANTS: Glenville, Conn.; Franklin, Mass.; Newburgh, N. Y.; Detroit, Mich.; Westerly, R. I. — ENGINEERING AND RESEARCH LABORATORIES: Glenville, Conn.

DOW CORNING
SILICONES

give motors more muscles



RELIANCE 20 hp (class H) Motor
330 Pounds Lighter than Conventional Design

For maximum safety, carrier planes are fueled and defueled immediately before take-off or after landing. Several fast reversible pumps are used, any of which can fill or empty a plane's tanks within minutes. The pumps and their motors are big and heavy, however. So much so that the Navy challenged manufacturers to produce new motors which would combine top dependability and absolute minimum weight.

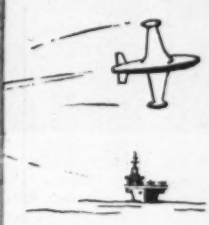
The Reliance Electric & Engineering Company attacked the problem both inside and out. They made the entire TENV frame and the mounting brackets of aluminum, ribbed for maximum heat dissipation. On the inside, silicone (Class H) insulation raises the power-per-pound ratio by over 50%, and also provides extra resistance to weathering and salt spray. As a result, the finished motors are among the smallest and lightest ever made in their class. The 20 hp unit, for example, weighs some 330 pounds less than the conventional 20 hp motor. Already they have been specified for the new super carriers Forrestal and Saratoga.

That's typical of the "design-ability" of Class H insulation made with Dow Corning silicones. Adaptable to any electrical equipment and costing only slightly more than the next best class of insulation, it can be used to increase the power-per-pound ratio or to extend the life of electrical machinery over ten times. For better performance, lower maintenance costs, and greater sales appeal, alert design and management men specify Class H insulation made with Dow Corning silicones

first in silicones

DOW CORNING
CORPORATION

MIDLAND, MICHIGAN



mail this coupon today!

Dow Corning Corporation, Dept. Q-16, Midland, Michigan
Please send me

- ☐ List of Class H rewind shops
- ☐ More performance data on Class H
- ☐ List of Class H Motor and
- ☐ Class H Transformer Manufacturers
- ☐ "Tall Tales and Fabulous Facts" about silicone products

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Branch Offices in ATLANTA • CHICAGO • CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEW YORK • WASHINGTON, D. C. (SILVER SPRING, MD.)
Canada: Dow Corning Silicones Ltd., Toronto • Great Britain: Midland Silicones Ltd., London • France: Cie. St. Gobain, Paris

AMF

Everlock

"CHISEL EDGE" LOCK WASHERS

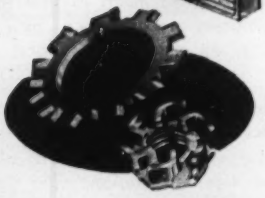
The Washer That Has The Edge

helps put the "LOCK" in Admiral's "locked-in stability"

Placed at strategic points in the chassis, Everlock lockwashers help keep Admiral TV sets at their brilliant best. Everlock's exclusive alternating chisel edges actually bite into both work and screw—provide fastenings that are *permanently secure.*

Remaining tight for the life of the product, Everlock lockwashers, locknuts and lock terminals help to safeguard many of America's foremost products.

If permanent, vibration-proof fastenings are part of *your* production picture, remember—with Everlock, you can *fasten* it and *forget* it. In sizes and materials to meet any specifications.

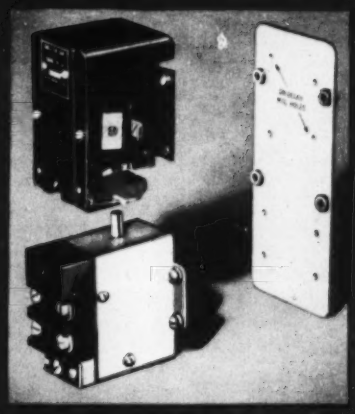


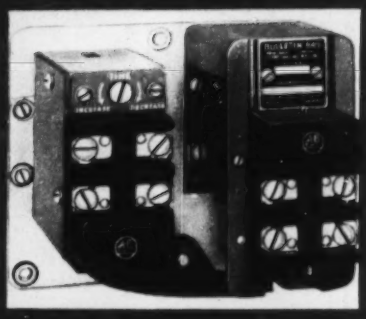
A full line of Everlock lockwashers and locknuts. Write for free catalog.

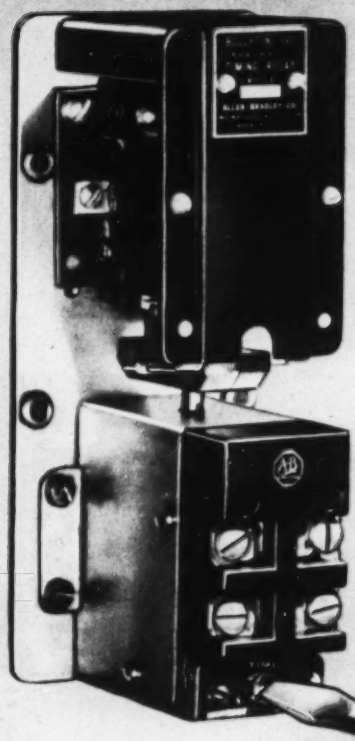
"EVERLOCK" IS THE REGISTERED TRADEMARK OF THOMPSON-BREMER & COMPANY

● *Write for information or contact your nearby Everlock respresentative.*

Kenneth D. DeLaney Dayton 3, Ohio	J. M. Murphy Manchester, Connecticut	W. L. Barth, Jr. Chicago 34, Illinois	Thom Lundeen Moline, Illinois	Richard C. Dudek Beverly Hills, California	J. J. McIntosh Atlanta 6, Georgia
Oscar P. Martin Lakewood 7, Ohio	Russell T. Brosius Philadelphia 3, Pa.	C. W. McNeil Houston, Texas	Forrest Moschner St. Louis, Missouri	P. L. Robertson Milton, Ontario, Canada	Donald G. Tooling Indianapolis 44, Ind.
J. Ramsey Reese, Inc. New York 7, New York	Sam T. Keller Detroit 1, Michigan	Leonard F. Berg St. Paul 14, Minnesota	A. J. Murphy DeWitt, New York	Sam T. Gleaves Louisville 5, Kentucky	Oregon Indus. Factors Portland 1, Oregon







BULLETIN 849 PNEUMATIC TIMING RELAY

Solenoid Operated

EASY TO ADJUST

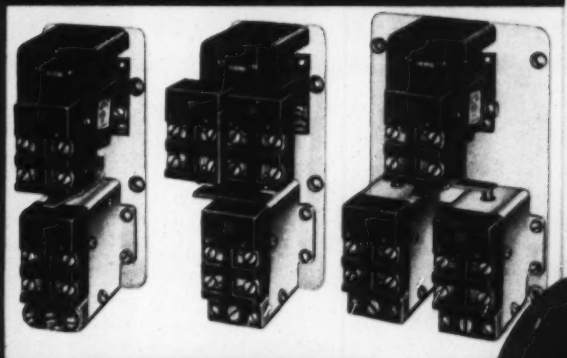
for Timing Intervals from 10 Cycles to 3 Minutes

Here is a compact . . . easy to adjust . . . solenoid type pneumatic timer with quick make-and-break silver alloy contacts that operates with an accuracy of ±10% . . . irrespective of temperature, humidity, or vibration. Its wide timing range . . . from 10 cycles to 3 minutes . . . makes it the ideal timer for hundreds of industrial applications.

There are one set of normally open and one set of normally closed contacts. Additional contacts may be mounted on the timer frame and actuated by the same solenoid mechanism. Wiring terminals are all accessible from the front. Send for illustrated Bulletin 849, today.

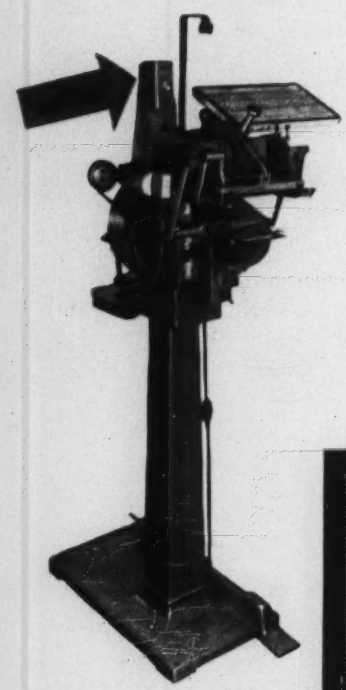
Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

AVAILABLE IN MANY CONTACT COMBINATIONS

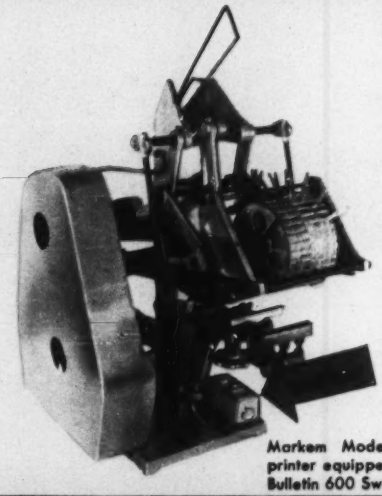


ALLEN-BRADLEY
QUALITY
TIMING RELAYS

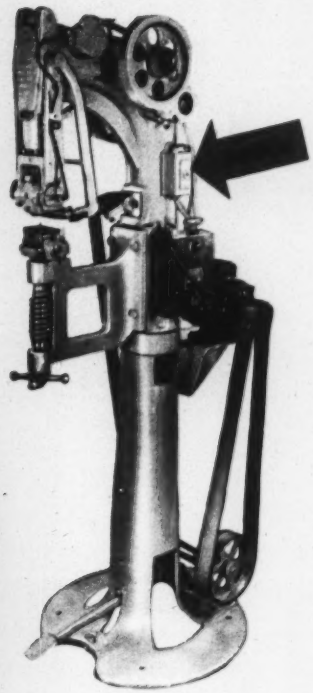
2-54-R



Markem Model 105 heavy duty box and label printer equipped with an A-B Bulletin 600 Manual Starting Switch.



Markem Model 45AC printer equipped with a Bulletin 600 Switch.



Markem No. 2 embosser for indenting and coloring on plastics, wood, leather, etc., with A-B Bulletin 600 Switch.

SNAP SWITCH *with* OVERLOAD BREAKER FOR 1 HP MOTORS AND SMALLER

● Burnouts of small motors can often cause serious production delays. Therefore, dependable overload protection is absolutely essential . . . and for motors of 1 hp or less the Allen-Bradley Bulletin 600 Starting Switch is the logical answer.

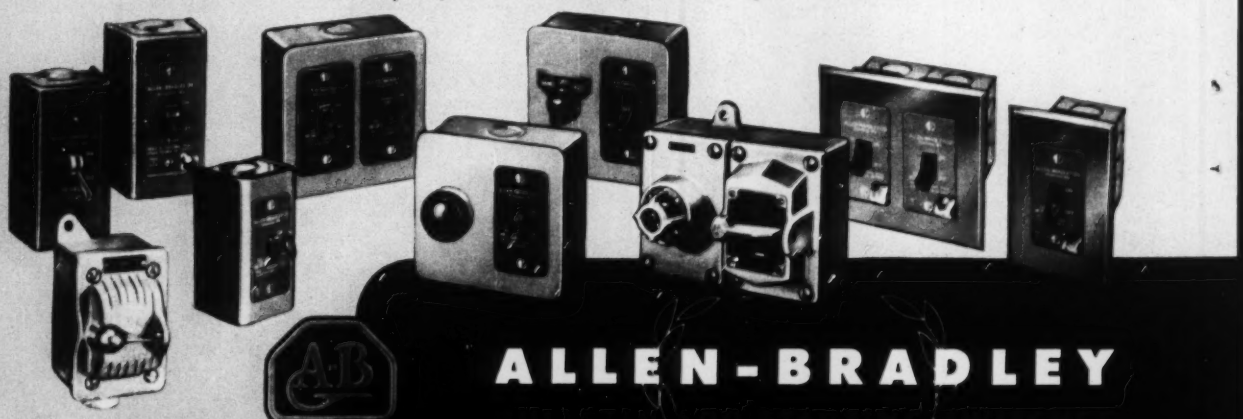
It has a built-in thermal overload breaker which trips the toggle switch in case the motor is overloaded . . . and you can't keep the switch closed until the overload on the motor is cleared.

The Bulletin 600 Manual Starting Switch is ideal for small a-c and d-c motors on space heaters, stokers, refrigeration compressors, fans, pumps, packaging machines, labelers, grinders, and other light machinery.

Available in open type construction and also in standard sheet metal enclosures, waterproof and weatherproof enclosures, and gastight enclosures for installations in hazardous gas locations.

Bulletin 600 Manual Starting Switches can be furnished in various auxiliary combinations—namely, with pilot lights, selector switches, and key and lever switches, as illustrated below. They will fit into standard conduit switch boxes if desired. The double break, silver alloy contacts need no attention. Bulletin 600 gives dimensions and other data.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

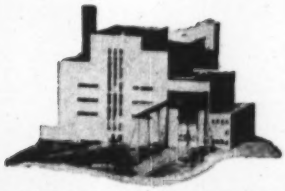


A few examples of the variety of enclosure combinations in the Bulletin 600 Manual Starting Switch line.

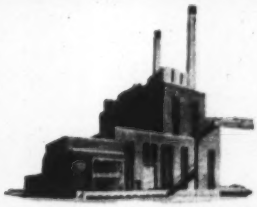
2-54-MR

ALLEN-BRADLEY

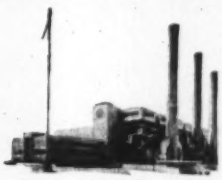
QUALITY



Central Hudson Gas & Electric Corp. — DANSKAMMER

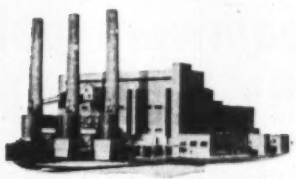


Cincinnati Gas & Electric Co. — BECKJORD

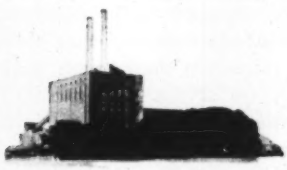


Dayton Power & Light Co. — O. H. HUTCHINGS

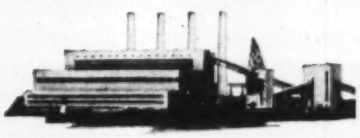
Duke Power Co. — LEE



Metropolitan Edison Co. — TITUS



Niagara Mohawk Power Corp. — DUNKIRK



Public Service Electric & Gas Co. — SEWAREN

Rochester Gas & Electric Corp. — RUSSELL

10 OF THE TOP 15

The annual report of the Federal Power Commission entitled "Steam-Electric Plant Construction Cost and Annual Production Expenses," covering the year 1952, became available in December 1953.

Among other interesting and significant data therein were the "Average Btu per Kilowatt-hour Net Generation" rates for 331 power stations reporting from all sections of the country. Ten of the fifteen steam-electric stations having the *lowest* annual heat rates — as revealed by the report — are pictured here.

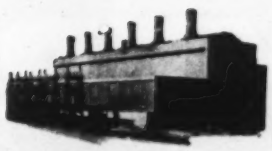
All the steam generating equipment in these ten stations was designed and built by Combustion Engineering.

B-723

COMBUSTION ENGINEERING, *Inc.*

200 Madison Avenue, New York 16, N. Y.

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE



T.V.A. — JOHNSONVILLE

Wisconsin Electric Power Co. — PORT WASHINGTON

The new North American
FJ-2 carrier-based jet fighter

and when you think of Die Castings
THINK OF

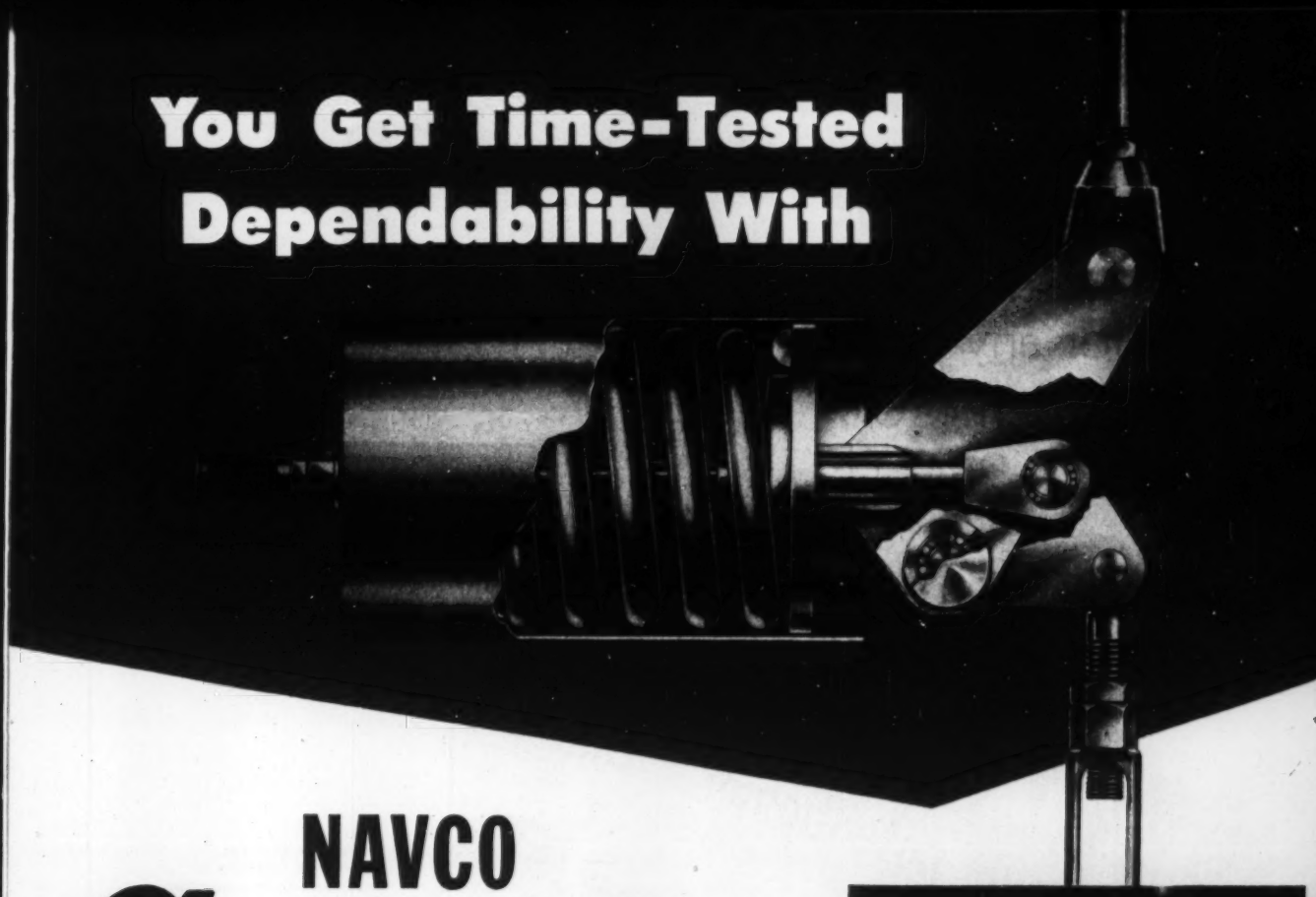
Production Teamwork puts the NAVY FURY in the Air!

AMONG the many specialists supplying component parts for the Navy's new "Fury" Jet Fighter is Parker White Metal Company. Parker Die Castings are used on the upper fuselage door access assembly, fuselage cooling duct system, fuel system, air fuel locks, air valves on intake ram, surface control system and as components of the highly classified gun-camera. Parker Die Castings are economical, strong and light weight. Machining is virtually eliminated, thus reducing costs. You will find Parker Die Castings highly practical from your point of view. Consult with Parker engineers on your next die casting requirements. Nearly a half century of experience is yours for the asking.

Parker White-Metal Company • 2153 McKinley Ave., Erie, Pa.

PARKER ALUMINUM and ZINC *Die Castings*

You Get Time-Tested Dependability With



NAVCO Counterpoise*

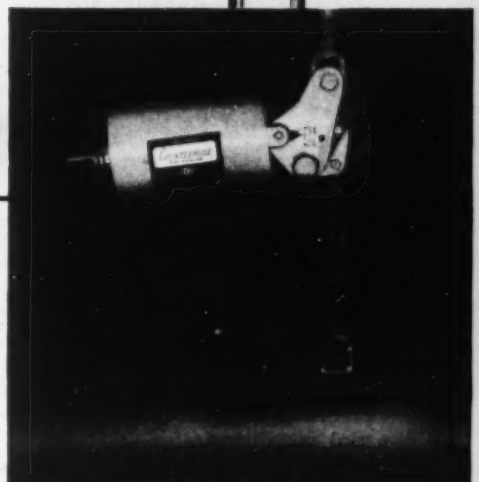
Pipe Hangers

The constant load-carrying capacity of Navco Counterpoise* Pipe Hangers has been proven during an extended period of satisfactory service as the first accurate and efficient support for high temperature piping systems. They are being used extensively in steam generating stations, refineries and chemical plants.

The Counterpoise Hanger is a spring-actuated counterbalance. An ingenious system of linkage transforms the varying force of the spring in an accurate mathematical ratio to produce a load supporting effort of constant value throughout the entire range of expansion travel.

The design permits great flexibility of installation and saves valuable space in congested areas. All parts are ruggedly made and have a high safety factor, yet excess weight and oversize physical dimensions have been avoided to hold space and structural load requirements to a minimum.

The Navco Counterpoise Hanger is available in 16 different frame sizes with load capacities ranging from 200 to 16,000 pounds and expansion travels up to 12 inches. For detailed information on how you can get dependable support with this unique hanger, write today for our 12-page illustrated bulletin #153.



Note above how the flexible top connection permits the hanger assembly to fall in line with the direction of the load pull, so that horizontal travel of the piping has no appreciable effect on the hanger operation. The unit may be positioned at any angle. This affords flexibility in installations where close clearances are a factor.

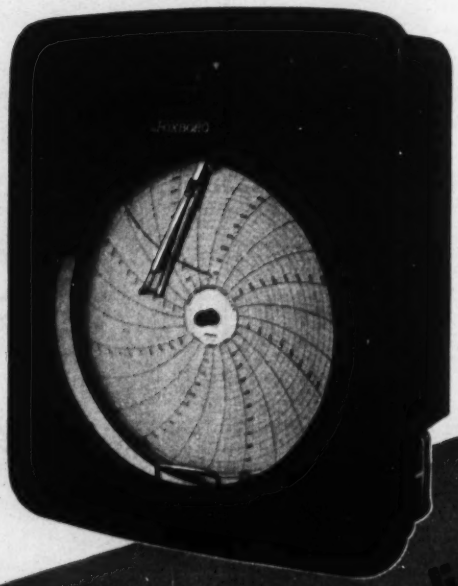
* *Counterpoise is a trade name of the National Valve & Manufacturing Company*

NATIONAL VALVE & MANUFACTURING COMPANY

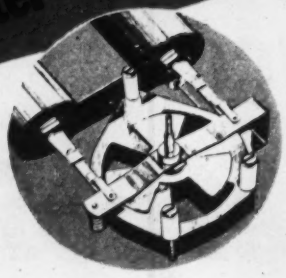
3108 LIBERTY AVENUE, PITTSBURGH 1, PENNSYLVANIA

New York • Chicago • Cleveland • Boston • Atlanta • Buffalo • Cincinnati

An unbeatable pyrometer for any range between -300° and +2800°F.



DYNALOG* ... the electronic potentiometer that has no slidewire!



This simple variable capacitor is important to potentiometer users because it eliminates the conventional, troublesome slidewire altogether; and it gives Dynalog Instruments the continuous *stepless* balancing which assures higher accuracy, closer control.

TOPS in simplicity . . . unequalled in its combination of accuracy, sensitivity, and speed of response . . . the Dynalog Potentiometer with standard thermocouples gives you unerring temperature measurement for any range up to 2800°F. Featuring *sustained* accuracy of ¼ of 1% of scale, it's an instrument of laboratory precision built to withstand the severest industrial conditions.

Unprecedented freedom from maintenance is the direct result of unique Dynalog design. There's no slidewire, no battery to standardize. There are no gears, belts, or high speed reversing motors. There's nothing to wear and cause dead space.

Single pen recording models provide full scale pen travel in 3 seconds standard, or as fast as 1 second without extra cost. The Multi-Record Dynalog provides color-coded records of up to 6 points at 6 second intervals. Both types give the convenience and low cost of circular charts.

Dynalog Potentiometers are also used for the measurement of pH, oxidation-reduction potential, and for other applications in which the process variable can be converted to a dc millivolt signal. They are available for pneumatic or electric control.

Write for your copy of Bulletin 427-1 which gives the whole story.

*Reg. U.S. Pat. Off.

THE FOXBORO COMPANY, 964 NEPONSET AVE., FOXBORO, MASS., U.S.A.

FOXBORO POTENTIOMETERS

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

Parts made of tough ANACONDA Phosphor Bronze wear better, last longer

Ten alloys are available in sheets, plates, strips, wire, rods, bars and seamless tubes.

Constant wear and flexings. Periodic stresses. Fatigue and corrosion. These are the things that can knock machine parts out of commission. But they can't hurt those shown above.

Here's why. All of them are made of ANACONDA Phosphor Bronze Alloys. And these copper-tin alloys are strong and tough. They are non-magnetic. They conduct heat and electricity well. And you can work them easily.

In bushings, gears and bearings Phosphor Bronze doggedly resists abrasion. In switches, springs, diaphragms and electrical contacts it keeps its high elasticity under conditions where less rugged alloys fail.

ANACONDA Prosphor Bronze comes in 10 standard compositions (including a free-cutting alloy). Tin content ranges from 1.25% to 10.0%.

Quality? Our record speaks for itself—a recent study of sheet metal covering two years' production shows that claimed unsuitable quality was at the amazingly low ratio of 400 pounds per million pounds shipped.

Tell us what you make and how it's used. We'll help you select the correct Phosphor Bronze Alloy. *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.* 5484

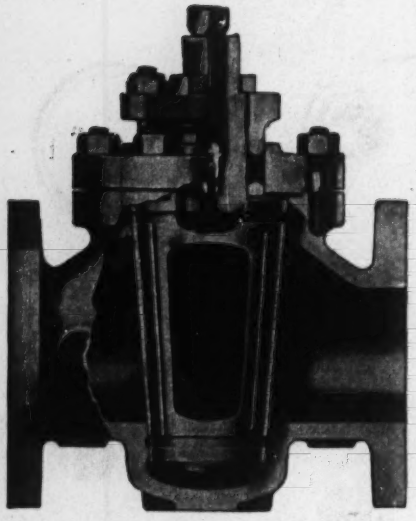
ANACONDA®
PHOSPHOR BRONZE

Sheets • Plates • Strips • Wire • Rods
Bars • Seamless Tubes • Special Shapes

WALWORTH

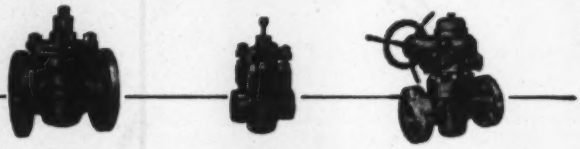
Lubricated

Plug Valves



for TOUGH assignments

where tight shut-off...
and easy operation
are "MUSTS"



Walworth Lubricated Plug Valves Offer These Advantages

- Complete surrounding of ports with resistant lubricant affords positive seal against leakage.
- Lubricant grooving system assures ease of operation — tight shut-off — greater protection against corrosion.
- Body and plug fully protected by lubricant from attack by line fluids.
- Quarter turn opens or closes valve.
- Made in a complete range of sizes ½" to 26" and for pressures from 175 to 5,000 psi., and for vacuum requirements.

For handling petroleum products, natural or manufactured gas, acids, alkalies, solvents, slimes, slurries . . . in fact for almost any hard-to-handle liquids—there's a Walworth Lubricated Plug Valve designed for the job.

Easy to operate, tight sealing, resistant to wear and corrosion, Walworth Lubricated Plug Valves assure long years of dependable service at low operating cost.

Walworth Lubricated Plug Valves are available in sizes ½" to 26" for pressures from 175 to 5,000 psi., and for vacuum requirements. For full details—prices, sizes, dimensions, and other pertinent data, see your Walworth distributor or write to:

WALWORTH

valves • fittings • pipe wrenches

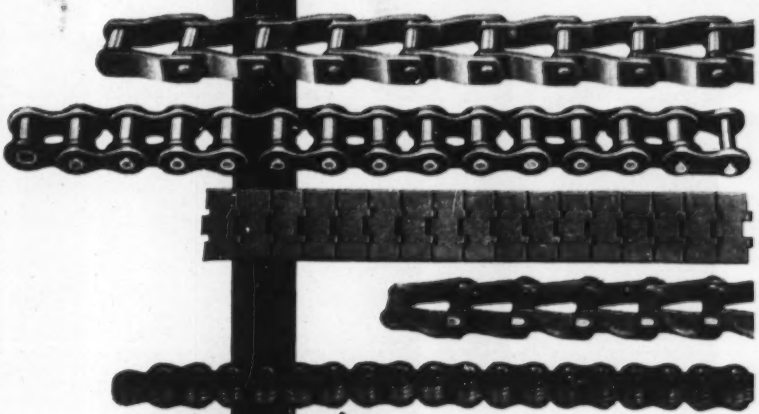
80 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

des n your machines

with these dvantages

t only CHAINS give you!



Chabelco® Chains

Roller Chains

TableTop® Chains

Cast Chains

Leaf Chains

Your Chain Belt Field Sales Engineer will be happy to help you select the size and type of chain and sprocket that will best suit your needs . . . provide the most efficient drive or conveyor at the lowest cost. Call him or mail the coupon today.

Always the one best chain for each service

CHAIN BELT COMPANY

CHAIN BELT COMPANY
4765 W. Greenfield Ave.,
Milwaukee, Wisconsin

54-501

I want information on chains for.....
Send literature on: ☐ Chabelco Chains; ☐ Roller Chains; ☐ TableTop; ☐ Leaf Chains; ☐ Cast Chains; ☐ Sprockets. ☐ Have a Chain Belt Man call.

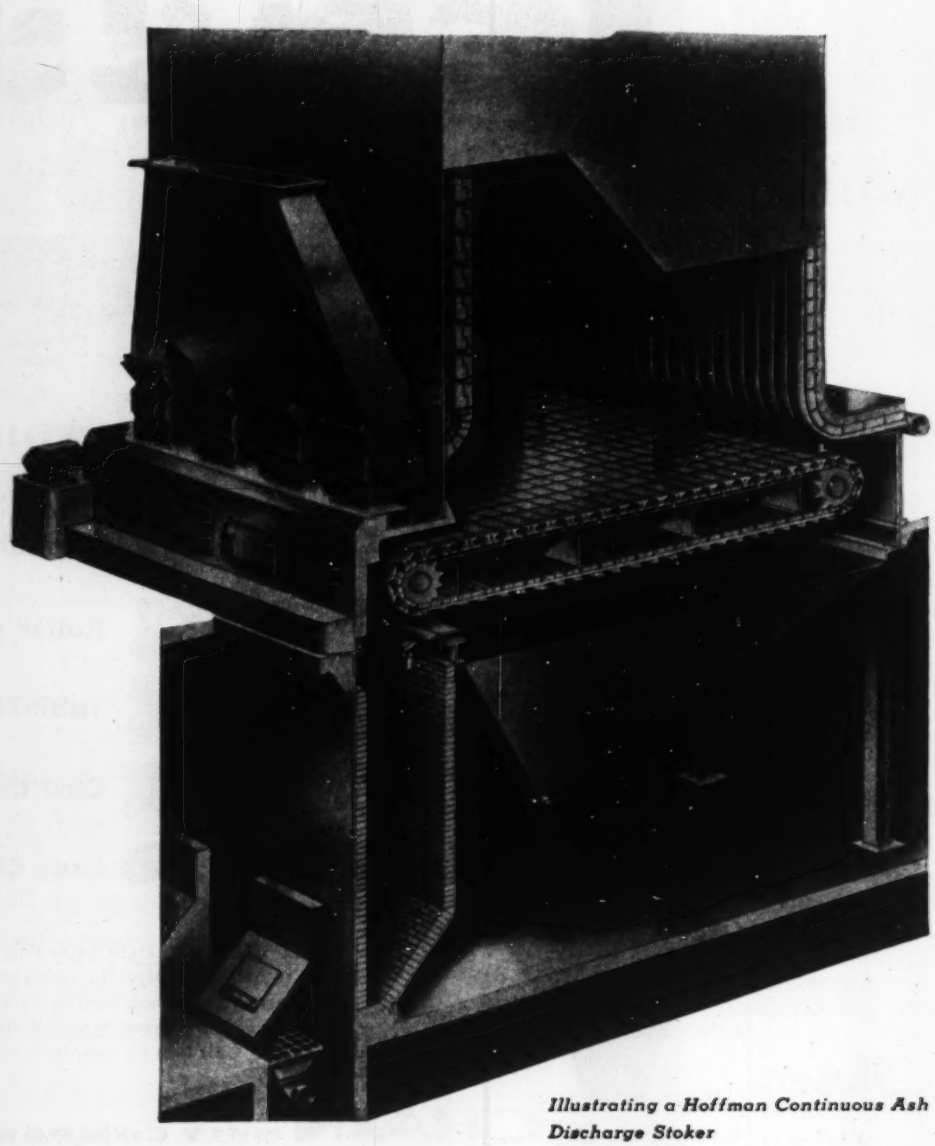
Name.....

Company.....

Address.....

City.....*Zone*.....*State*.....

Firite FIRST SPREADER



Illustrating a Hoffman Continuous Ash Discharge Stoker

HOFFMAN COMBUSTION ENGINEERING COMPANY

HOFFMAN Spreader Stokers

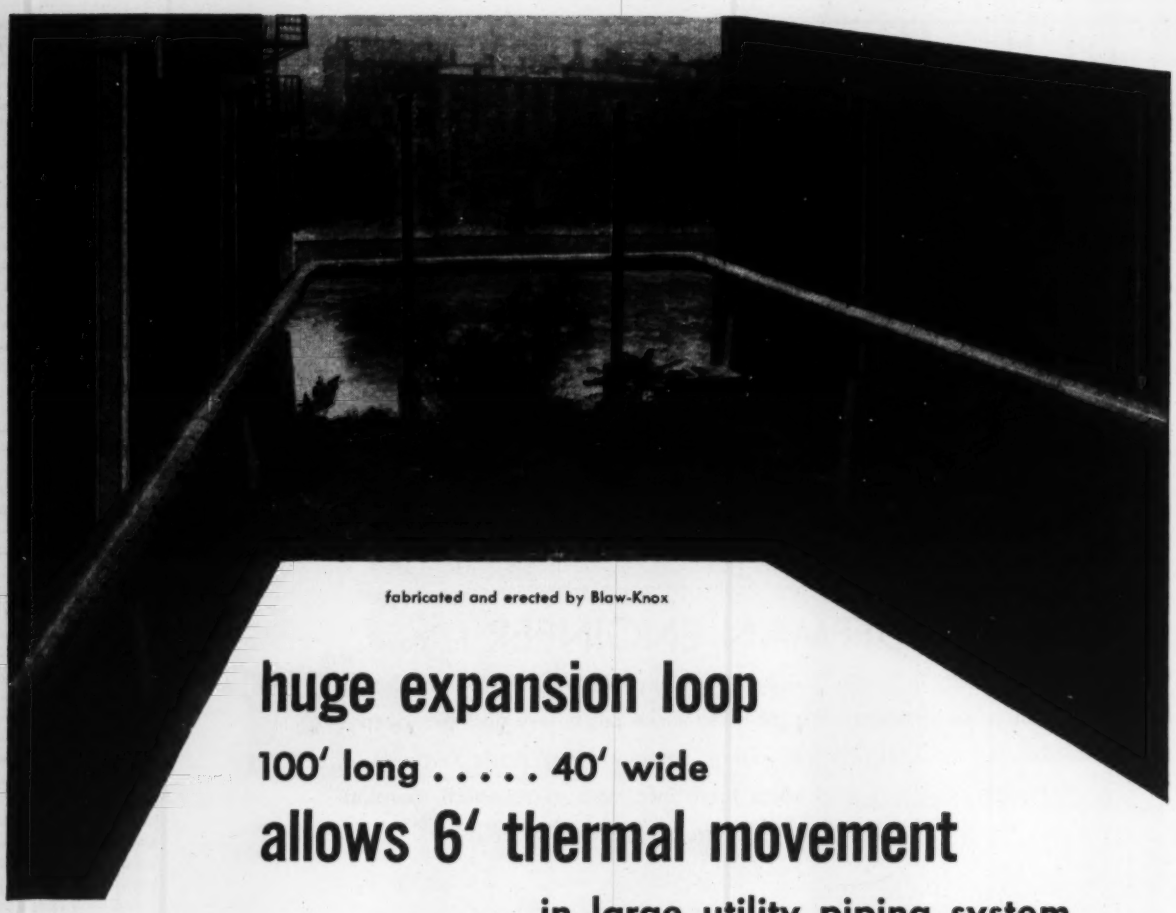
The HOFFMAN ENGINEER In Your community is a man trained in our engineering, service and installation departments. His job is to serve customers and prospective buyers—to bring to consulting engineers the basic features of Hoffman stokers and keep them informed of research developments—cooperating in selective buying.

NATION-WIDE REPRESENTATION

NEW YORK 165 Broadway	WO. 2-5744	**LEXINGTON, KY.** 126 Westwood Dr.	2-6206
BALTIMORE, MD. 2125 Maryland Ave.	BE. 4740	**BUFFALO, N. Y.** 54 N. Colvin Dr.	DEL. 8141
COLUMBUS, OHIO 1815 Oak St.	EV. 2570	**NASHVILLE, TENN.** 123 Third Ave., No.,	6-8151
CHICAGO, ILL. 30 N. LaSalle	CEN. 6-7004	**RICHMOND, VA.** 615 E. Franklin St.	3-5357
BOSTON, MASS. 120 Boylston St.	DEV. 8-9483	**CLEVELAND, OHIO** 1655 Lauderdale	LAKE. 1-2553
INDIANAPOLIS, IND. 5217 Hinesley Ave.	BROAD. 8086	**DENVER, COL.** 1351 Grant St.	AC. 3573
SYRACUSE, N. Y. 520 Robineau Road	76-9752	**SALT LAKE CITY, UTAH** First So. and Second West,	3-5831

General Offices: **Marquette Bldg. Detroit 26, Mich.**

Works: **Fairmont, W. Va., and Detroit, Mich.**



fabricated and erected by Blaw-Knox

huge expansion loop

100′ long . . . . . 40′ wide

allows 6′ thermal movement

. . . in large utility piping system

This tremendous expansion loop is only one part of a ten-inch power piping line which carries steam at 650# pressure and 750° Fahrenheit for nearly a mile throughout the downtown area of a large city. All bends were fabricated in our shops . . . and installed in the field by our service force, using Blaw-Knox functional hangers and vibration eliminators.

An unusual job . . . and you'll probably never need one just like it. But it points up the kind of service we offer you. For we have the experience and the facilities to handle any type of piping problem.

On a job you place with us, you'll have the benefits of modern shop facilities for hot and cold bending, welding and fabricating all types of piping. A metallurgical research laboratory to assure you of the latest developments in high pressure, high temperature piping. Newest types of testing equipment to insure the soundness and strength of the piping under the most severe operating conditions.

And in addition, a complete service force equipped with modern machinery for field erection . . . and the necessary manpower to handle any size job.

What's your power piping problem?

We are prepared to (1) engineer, fabricate and erect your job . . . (2) simply fabricate and erect . . . or (3) fabricate only.

Our engineers will quote from your drawings . . . or, where desired, make a field study of your piping requirements before quoting.

Write us your requirements . . . and we'll provide the service you need.

To get more information on piping for industry write for your copy of Bulletin No. 2443.

BLAW-KNOX COMPANY

Power Piping and Sprinkler Division

Pittsburgh 33, Pennsylvania

BLAW-KNOX

POWER PIPING

Complete prefabricated power piping systems for all pressures and temperatures . . . plus complete line of functional spring hangers • rigid hanger assemblies • overhead roller assemblies • supports • vibration eliminators

SANBORN 150 SERIES
OSCILLOGRAPHIC RECORDERS

The BASIC four-channel assembly includes: Cabinet, Recorder, and, for each channel, a BUILT-IN unit (A), which comprises a Driver Amplifier with frame, and a Power Supply with control panel.

(A)

A NEW design concept that brings even greater versatility to industrial OSCILLOGRAPHIC RECORDING

(B)

You have a CHOICE of readily interchangeable, plug-in Preamplifiers (B) for EACH channel, as described below.

The new Sanborn 150 Series offers greater operating efficiency and convenience, and encompasses a *variety of uses* which include the accurate recording of almost every phenomenon whose frequency spectrum lies in the range from 0 to 100 cycles per second.

A *wide selection* of plug-in preamplifiers, or "front end" units, such as (B) above, are completely interchangeable in any or all channels of the 150 Series amplifier section, where they simply plug in to the driver amplifier and power supply, (A) above, which are already in place.

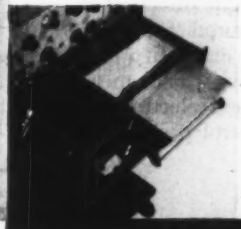
Available plug-in Preamplifiers include: AC-DC, CARRIER, SERVO-MONITOR, DC COUPLING, LOG-AUDIO, and LOW LEVEL. Blank plug-in assemblies are also available for users to make input circuits for special measurement problems.

And, there are the popular Sanborn advantages: a high torque movement (200,000 dyne cms per cm deflection), direct *inkless* recording in *true rectangular coordinates*, and provision for code and time markings.

A new catalog on Sanborn Oscillographic Recording Systems and their components will be sent gladly on request.

OTHER SANBORN IMPROVEMENTS

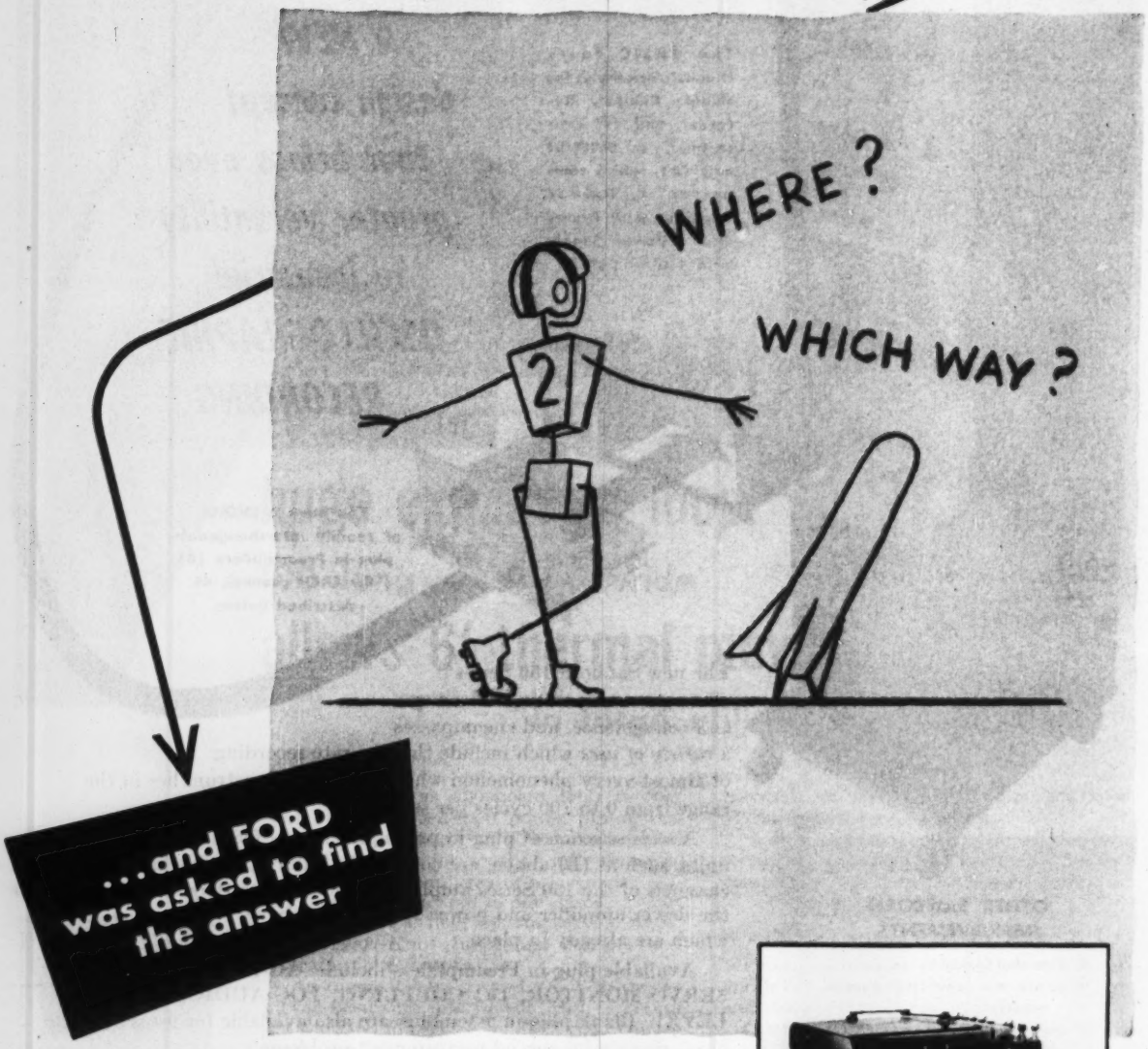
- Extended frequency response.
- Improved regulated power supply.
- Individual stylus temperature control for EACH channel.
- Improved, single control, paper speed selector. Nine speeds — 0.25 to 100 mm/sec.
- Recorder slides out, if desired, for better view of recorded events, or for notations on record (illustrated at right).
- Improved control of input signals by use of 1, 2, 5 ratios on attenuator.



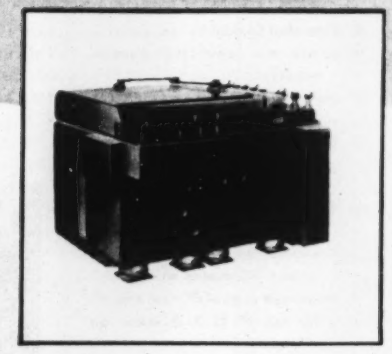
SANBORN COMPANY
INDUSTRIAL DIVISION

195 MASSACHUSETTS AVENUE
CAMBRIDGE 39, MASS.

HOW TO KICK OFF A ROCKET
in the right direction



Load! Aim! Launch! And off goes a rocket from shipboard . . . but not without precise devices that start the rocket in the right direction. Devices . . . such as Ford Instrument has manufactured for the Armed Forces since 1915. For from the vast engineering and production facilities of the Ford Instrument Company, come the mechanical, hydraulic, electro-mechanical, magnetic and electronic instruments that bring us our "tomorrows" today. Control problems of both Industry and the Military are Ford specialties.



14

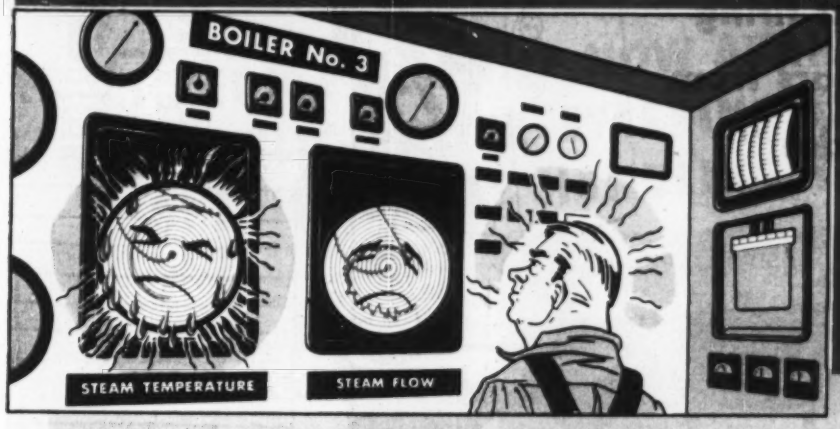
You can see why a job with Ford Instrument offers young engineers a challenge. If you can qualify, there may be a spot for you in automatic control development at Ford. Write for brochure about products or job opportunities. State your preference.

FORD

FORD INSTRUMENT COMPANY
DIVISION OF THE SPERRY CORPORATION
31-10 Thomson Avenue, Long Island City 1, N. Y.

GIVE Your BOILERS a BREAK . . .

MODERNIZE YOUR CLEANING PRACTICES . . .



it will SAVE YOU MONEY

ELIMINATE

- Hand lancing—it's costly, inefficient, inadequate
- Shutdowns for cleaning slag deposits
- Load limitations because of slag accumulations
- Load limitations because of temperatures being exceeded
- Waste in fuel due to surface fouling
- Waste in steam by worn or inefficient cleaning devices

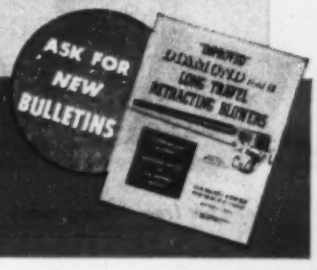
INSTALL

- Diamond Model IK long retracting blowers to clean slagged tube banks (Send for Bulletin 1880)
- Diamond Model IR short retracting blowers for water-wall cleaning (Send for Bulletin 1879)
- Diamond Model G9B rotating steam blowers for tube banks (Send for Bulletin 1137)
- Diamond Model A2E rotating air-puff blowers for tube banks (Send for Bulletin 1881)
- Diamond mechanized and automatic drives and controls

REALIZE

- Higher boiler capacity—mechanical cleaning is uniformly better
- Higher boiler availability—fixed charges are high
- Lower boiler maintenance—cleanliness reduces deterioration
- Higher boiler efficiency—a continual saving in fuel
- Better operating practices—mechanization improves morale

6614



50th ANNIVERSARY 1903-1953

DIAMOND POWER SPECIALTY CORP.

LANCASTER, OHIO

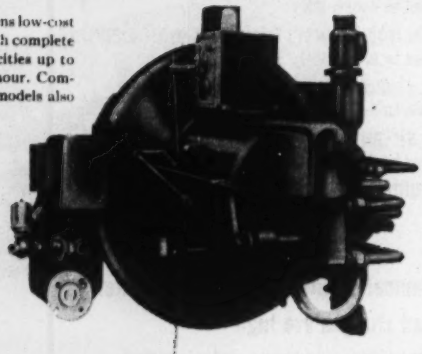
Diamond Specialty Limited • Windsor, Ontario

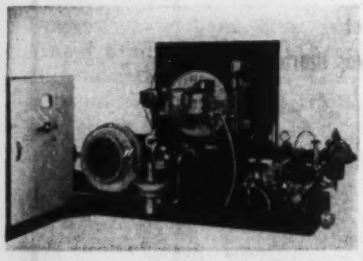
Is inefficient firing stealing dollars from your pocket?

PETRO INDUSTRIAL OIL BURNER

and save 3 ways

Rotary type. Burns low-cost heavy fuel oil with complete reliability. Capacities up to 200 gallons per hour. Combination oil-gas models also available.





Petro "Packaged Unit" (for oil or gas or both). A complete combustion system in which all elements are correctly balanced and integrated. Simply bolt to boiler front and make service connections and it's ready to go.

1. Fire low-cost oils

Petro fires the heavy fuel oils (Nos. 5 and 6) which average 8% richer in heat value than the light burner oils, and cost less per gallon.

2. Save fuel and labor

They efficiently fire heavy oils with complete dependability, following load changes automatically. This makes fuel go farther and saves labor.

3. Low maintenance cost

They are sturdily built and thoroughly reliable. This means low maintenance costs.

There's a Petro burner to fit almost every boiler, in sizes from 11 to 200 gallons per hour.

Heating contractors everywhere recommend and install Petro oil equipment. For illustrated catalog write Petro, 3037 West 106th Street, Cleveland 11, Ohio.

In Canada, write 2231 Bloor Street West, Toronto Ontario.

Residential Oil and Gas Burners, Oil and Gas Furnaces and Boilers, Industrial and Commercial Oil, Gas and Oil-Gas Combination Burners

PETRO

T.M. REG. U.S. PAT. OFF.

Over 50 Years of Leadership in Automatic Heating and Power Equipment

Send for free catalog today . . .

HYDRAULICS FOR MOBILE EQUIPMENT

VOL. 2

Mobile Equipment News

VICKERS INCORPORATED, DETROIT, MICHIGAN

IMPROVES PERFORMANCE • CUTS COSTS

NO. 4

VICKERS® VT16 PUMP NOW AVAILABLE FOR HYDRAULIC POWER STEERING OF TRUCKS AND MATERIALS HANDLING VEHICLES

The Vickers Series VT16 pump is used more widely than all other makes combined for the power steering of automobiles. It is now available for the first time for the hydraulic power steering of trucks and materials handling vehicles. It has all the characteristics important to this service and is used in a separate hydraulic circuit for steering only.

COMPLETE PACKAGE

Series VT16 has integral volume control valve and relief valve . . . also an integral oil reservoir. This is a complete hydraulic power package for steering.

SIMPLIFIED INSTALLATION

This compact and complete power package is easily and quickly installed. All you need to do is bolt it on, make two hydraulic connections, and couple the power.

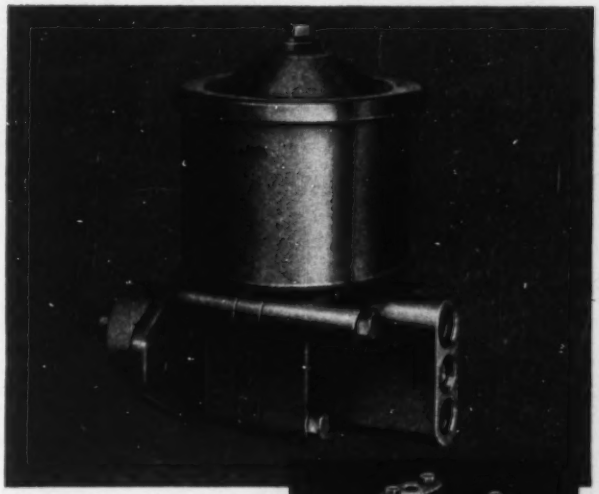
LONGER PUMP LIFE

The exclusive Vickers "Hydraulic Balance" eliminates pressure-induced bearing loads and the consequent wear. These lighter bearing loads mean much longer bearing and pump life.

NO LOAD STARTING

At rest and normal starting speeds, the sliding vanes are retracted; only after engine fires do vanes extend and pumping begin.

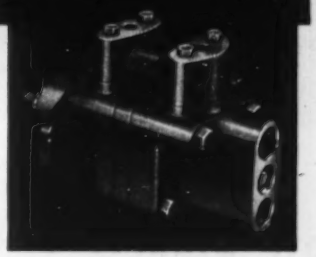
ASK FOR BULLETIN M-5104A



Series VT16 Vickers Pump with integral volume control and relief valves and oil reservoir. For hydraulic power steering.

HIGH OPERATING EFFICIENCY

The vane type construction, hydraulic balance and automatic maintenance of optimum running clearances enable these pumps to deliver more oil with less power. This high operating efficiency is maintained throughout the long pump life.



Series VT17 Vickers Pump is similar to the VT 16 except that it does not include the oil reservoir.

VICKERS Incorporated

DIVISION OF THE SPERRY CORPORATION

1500 OAKMAN BLVD. • DETROIT 32, MICH.

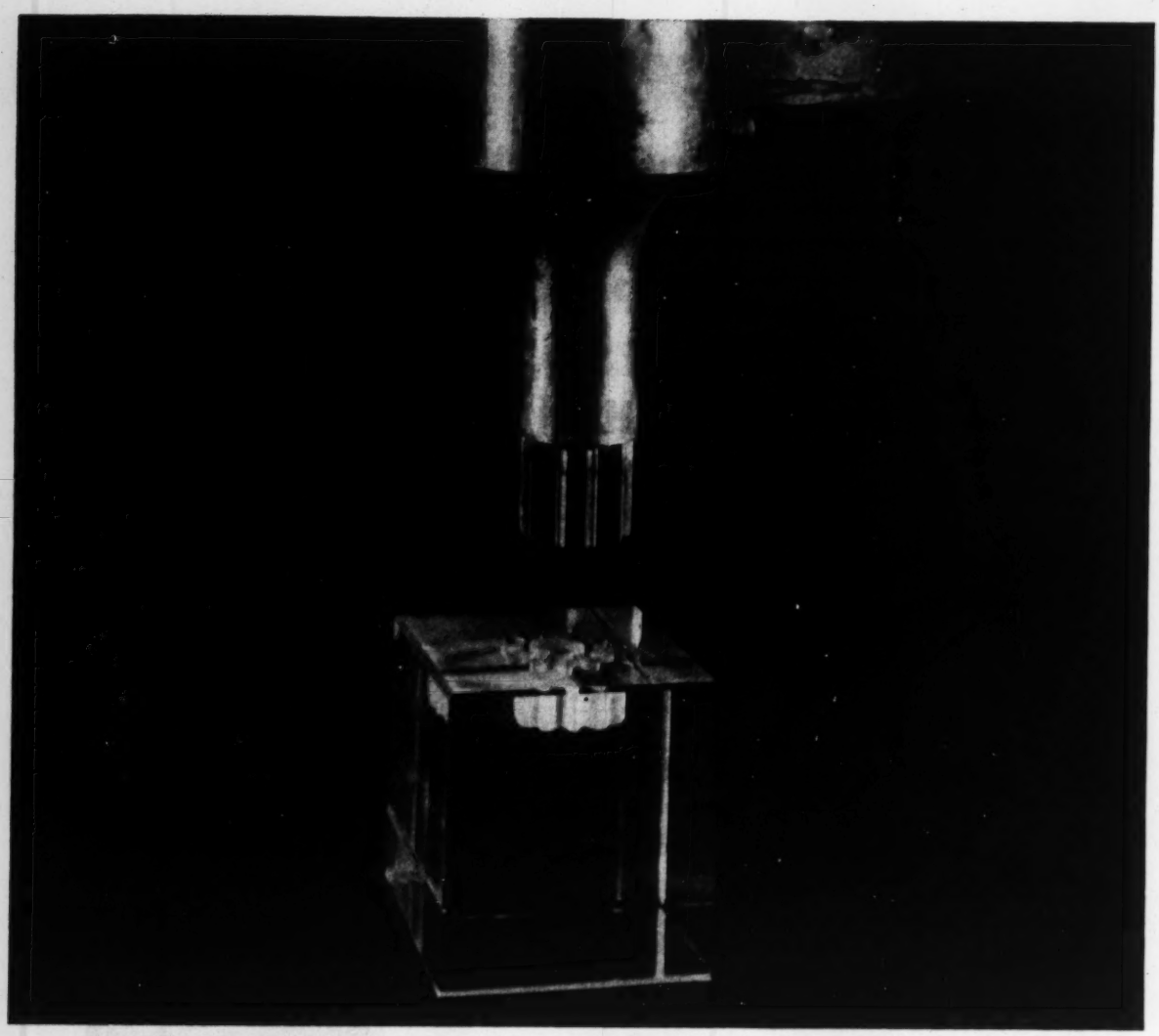
Application Engineering Offices: ATLANTA • CHICAGO (Metropolitan) • CINCINNATI • CLEVELAND • DETROIT • HOUSTON LOS ANGELES (Metropolitan) • NEW YORK (Metropolitan) • PHILADELPHIA (Metropolitan) • PITTSBURGH • ROCHESTER • ROCKFORD • SEATTLE • TULSA • WASHINGTON • WORCESTER

VICKERS® HYDRAULIC POWER STEERING BOOSTER

EFFORTLESS • POSITIVE • SHOCKLESS

6726

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



Using high-frequency vibrations and low-cost abrasives, the Ultrasonic Machine Tool carves holes and patterns of all shapes in hard-to-work materials. Development of the tool climaxed more than 10 years of research and experimental work.

How SILENT SOUNDS CUT HOLES you can't drill

This common steel gear bites its way into a glass cube as smoothly as it would mesh with its mate.

And that's *something*, for chiseling through glass is quite a trick, even with a tool designed for the job.

Yet, as you can see, it's being done right here. And the machine that does it can also sharpen the hard metal tools used to cut other metals. It can cut diamonds without the use of diamond powder. Some day, it may even eliminate the heat-generated pain caused by your dentist's whirling drill, or provide a vastly improved method for breaking up kidney- and gallstones.

Now how does this revolutionary tool work? *By ultrasonic vibration.* It vibrates 27,000 times a second! Every vibration pounds water-borne abrasive against the surface you're cutting, and steadily chisels away tiny particles.

It took time to produce and control these vibrations. Over 10 years of research and trial-and-error experimentation! Then—with the help of Inco Nickel — the successful method was perfected.

Pure nickel, when placed in an electromagnetic field, contracts much more than other commercial metals, and returns to its original length. (Physicists call this "magnetostriction.") It is this motion — stepped up a hundredfold — that produces the vibrations which give the tool its bite.

There are many similar useful qualities found in Inco Nickel Alloys. Between them, pure nickel and Monel provided the key to the problems of the ultrasonic machine tool. Another of our metals may help to open a door now locked to you. Let's get together and work out that problem of *yours* — soon.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

Inco Nickel Alloys

Monel® • "R"® Monel • "K"® Monel "KR"® Monel • "S"® Monel • Incorel® Inconel "X"® • Inconel "W"® • Incoloy® Nimonic® Alloys • Nickel • Low Carbon Nickel • Duranickel®

INCO

Published by The American Society of Mechanical Engineers

Officers of the Society

LEWIS K. SILLCOX, *President*

J. L. KOPF, *Treasurer* C. E. DAVIES, *Secretary*

E. J. KATES, *Assistant Treasurer*

Publications Staff

GEORGE A. STETSON, *Editor* S. A. TUCKER, *Publications Mgr.*

K. W. CLENDINNING, *Managing Editor* M. H. MARTY, *Business Mgr.*

J. J. JAKLITSCH, JR., *Associate Editor* N. M. LOSEFF, *Asst. Business Mgr.*

E. S. NEWMAN, *News Editor*

J. FOSTER PETREE, *European Correspondent*

Publications Committee

PAUL T. NORTON, JR., *Chairman*

OTTO DE LORENZI W. E. REASER

COLIN CARMICHAEL KERR ATKINSON

JOSEPH SCHMERLER, PETER WALLACK } *Junior Advisory Members*

Regional Advisory Board

RICHARD L. ANTHONY—I H. M. CATHER—V

JOHN DE S. COUTINHO—II J. RUSSELL PARISH—VI

WILLIAM N RICHARDS—III J. KENNETH SALISBURY—VII

FRANCIS C. SMITH—IV JOHN H. KEYES—VIII

MECHANICAL ENGINEERING

Vol. 76 **April, 1954** **No. 4**

Management With Automatic Production . . . . . *C. E. Knight* 317

Using Optical Measurements in Engineering . . . . *N. A. Finkelstein* 321

Relating Sawmill "Waste" to Log Quality . . . . . *F. C. Simmons* 327

Die Engineering . . . . . *E. A. Reed* 331

Report on Progress in Railway Mechanical Engineering—1952–1953 (*Concluded*) 334

New Extrusion Techniques Developed . *H. Albers, G. Krause, and A. Greensite* 343

Editorial 315

Briefing the Record 346

European Survey 358

ASME Technical Digest . . 360

Contents of ASME Transactions . 369

Comments on Papers 370

Reviews of Books 374

ASME Boiler Code 377

ASME News 380

ASME Junior Forum 392

Engineering Societies Personnel Service 393

New Catalogs Guide 41

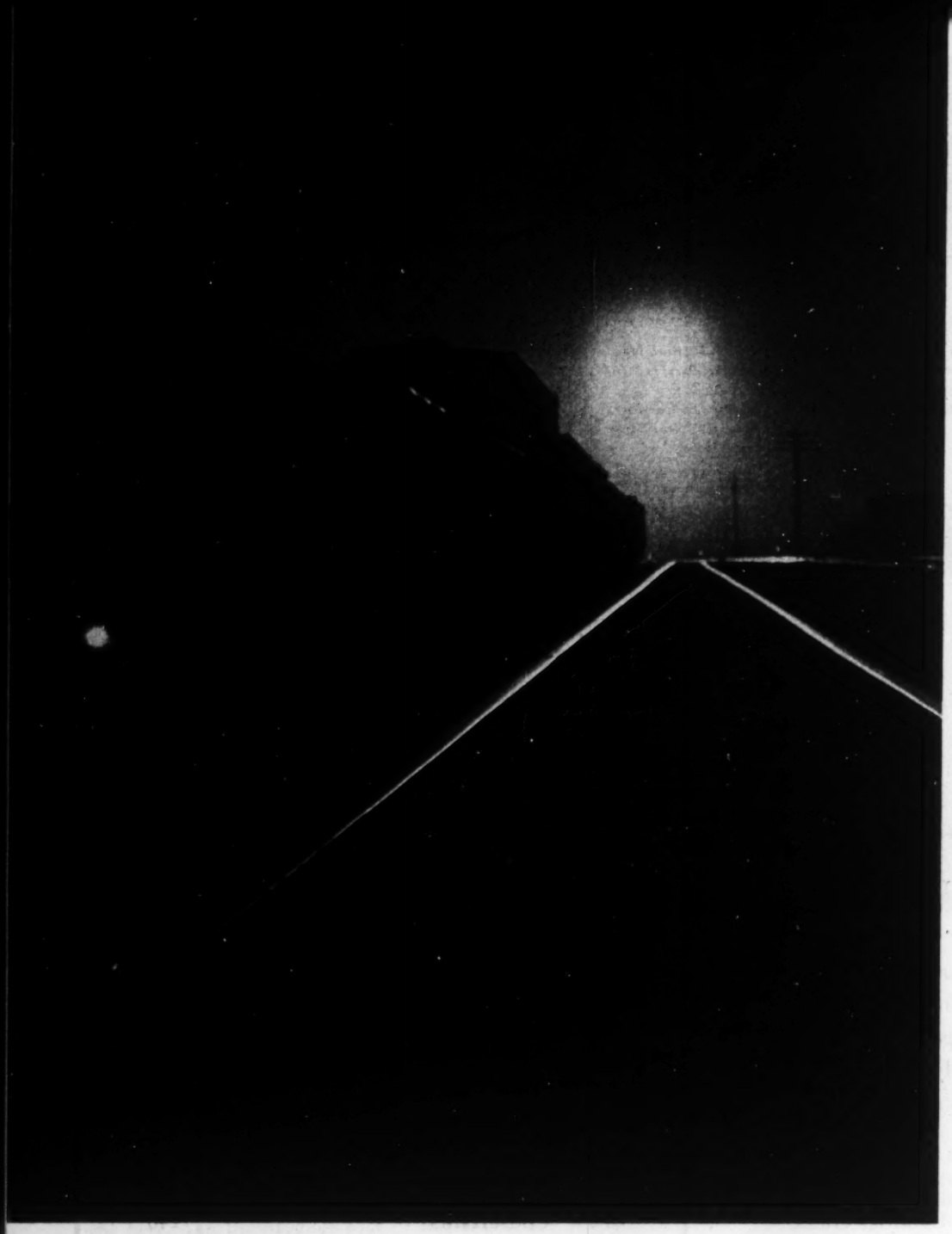
Classified Advertisements . . 141

Consultants 146

Advertisers 148

Published monthly by The American Society of Mechanical Engineers. Publication office at 20th and Northampton Streets, Easton, Pa. Editorial and Advertising departments at the headquarters of the Society, 29 West Thirty-Ninth Street, New York 18, N. Y. Cable address, "Dynamic," New York. Price to members and affiliates one year $3.50, single copy 50 cents, to nonmembers one year $7.00, single copy 75 cents. Extra postage to countries not in the Pan-American Union, $1.50; to Canada, 75 cents. Changes of address must be received at Society headquarters seven weeks before they are to be effective on the mailing list. Please send old as well as new address . . . . By-Laws: The Society shall not be responsible for statements or opinions advanced in papers or . . . printed in its publications (B13, Par. 4) . . . . Entered as second-class matter at the Post Office at Easton, Pa., under the Act of March 3, 1879 . . . . Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on January 17, 1921 . . . . Copyrighted, 1954, by The American Society of Mechanical Engineers. Member of the Audit Bureau of Circulation. Reprints from this publication may be made on condition that full credit be given MECHANICAL ENGINEERING and the author and that date of publication be stated.

MECHANICAL ENGINEERING is indexed by the Engineering Index, Inc.



Checking brake slack adjustment . . .

. . . on railroad gondola-car equipment is a standard part of car inspection before cars are made up into trains. Photograph courtesy of Westinghouse Air Brake Company, Air Brake Division.

Editorial

MECHANICAL ENGINEERING

April 1954, Vol. 76, No. 4 . George A. Stetson, *Editor*

ASME Preprint Policy

In recent years, preprints of papers presented at National meetings and conferences of the Professional Divisions have been playing an increasingly important role in the ASME publications program. In recognition of this fact, every effort is being expended to develop procedures to make these preprints readily available and to improve their quality.

The most recent development involving preprints of ASME papers has been the approval, by the Board on Technology, on the recommendation of the Publications Committee, of a statement of policy governing availability and distribution of preprints of technical papers and procedures set up to put the policy into effect.

The Problem

It will be remembered that, on recommendation of the Publications Committee approved by the Board on Technology, the Executive Committee of the ASME Council authorized annual distribution to each member of free coupons which could be exchanged for ten copies of ASME available numbered papers. As members began to exchange their free coupons for preprints, it become apparent that clarification was necessary of the conditions under which the Society could meet the demand for copies. For example, some members requested papers which were presented as far back as 1948 and because no copies were in stock, orders could not be filled. It was also discovered that stocks of some current papers were exhausted in some cases within a few weeks following the date of the meeting at which they were presented. Should such stocks be replenished? For how long a period should copies of a paper be kept in stock? Such questions demanded answers and definition of what is meant by "available."

In several cases requests were made for papers which, although they had been announced on programs and had been presented at meetings, had never been preprinted and, in some instances, had never been submitted in manuscript form. How could such papers be separated from those which did exist in preprint form? It was clear that the promise to provide copies of ASME papers had to be limited to papers which had been preprinted. Since every preprinted paper is given a number, it was apparent that coupons could be exchanged only for numbered papers. Hence the expression "numbered papers" has come to mean papers which have been issued in preprint form.

The third question relating to the exchange of coupons for copies of ASME technical papers is: How will members know what papers are available? Two convenient means of announcement exist, the programs of the meetings and conferences and Mechanical Engineering. Both the programs and the publications are under the control of the Society and hence can be considered authoritative and "official" sources of information. Hence steps are being taken in both these media to make it clear to members exactly what papers they may expect to receive in exchange for their coupons and how long each paper will be available.

The Policy

The foregoing paragraphs attempt to explain what is meant by "available numbered papers" and serve as a prelude to the policies recently adopted by the Board on Technology governing the availability and distribution of preprints of technical papers presented at ASME National meetings and Division conferences. The policies are phrased as follows:

"1 Coupons can be exchanged only for *available numbered* papers.

"2 All *numbered* papers will be *available* for 12 months beginning 30 days after the deadline date for receipt of manuscripts to be preprinted for a given meeting (for all meetings except the Annual Meeting in which case it will be 60 days after the deadline). Final dates of availability of papers will be specified for all meetings each year. An Availability List of papers for a specific meeting will be printed in the issue of Mechanical Engineering which carries the report of that meeting."

Making the Policy Work

It is one thing to adopt a policy and quite another to make it work. Hence, supplementing the policy, a set of procedures has been worked out so that members will receive promptly the copies of available numbered papers they may order under the terms of the policy. Most of these procedures apply to the Secretary's Office, but although every effort has been expended in trying to make them reasonable and operable, they involve co-operation and understanding on the part of members if maximum satisfaction is to result.

There are two simple rules to follow:

1 Order only preprints that bear an ASME preprint number.

2 Don't order papers a year or more old.

To make it easy to follow both rules the paper number and the date after which the preprint is no longer available will be found in the final program of the meeting at which the paper is presented, on the preprint itself, and in MECHANICAL ENGINEERING whenever the paper is mentioned in an availability list or in an abstract appearing in the "ASME Technical Digest" section.

Why a One-Year Limit?

Members may wonder why a limit of approximately one year has been set on the availability of preprints and how they may obtain copies of papers no longer officially available.

The answers to these questions are simple and reasonable. In a twelve-month period as many as five or six hundred preprints may be issued and as many as a thousand copies of each preprint may be prepared. It is not difficult to visualize the extent of storage space necessary to accommodate just one year's production of preprints.

It is a well-publicized fact that the Engineering Societies Building in New York is so overcrowded that two of the Founder Societies have been forced to house some of their departments in other buildings. Although plans for a new building are under active consideration, enlarged quarters will not be available for some time. Hence the simple fact must be faced that additional storage space does not exist and 1953 preprints have to go to make room for 1954 preprints.

Even if space were available, it is doubtful if sound arguments could be advanced for maintaining stocks of preprints for longer than a period of one year. Here again the time limit seems a reasonable one in the light of the following considerations: First, it must be conceded that demand for preprints decreases materially by the end of twelve months. Second, approximately half of the preprints are assigned for printing, with discussion, in Transactions, *Journal of Applied Mechanics*, MECHANICAL ENGINEERING, or, in some cases, the proceedings of the Division conferences at which they were presented. This printing in permanent form is completed within the one-year period and hence the paper becomes available in a much better and more correct form than is possible in preprints prepared from authors' manuscripts that have not undergone the rigorous process of discussion and correction.

After the Year Is Up

What about the papers that are not printed in the foregoing publications? They are preserved in bound form in the Engineering Societies Library where they can be consulted. Photostat or microfilm copies can be purchased, if desired, for years to come. The scheme works as follows: A copy of every ASME preprint is sent to the Engineering Societies Library as soon as the preprint is received from the printer. These copies are cataloged and placed in filing cases. If one of these preprints later appears in MECHANICAL ENGINEERING or Transactions, that preprint is removed from the Library cases. At the end of the year, all of the remaining preprints are bound, including manuscript copies of a few papers that were neither preprinted nor published by the Society. A list of these papers is published with the indexes of the periodical publications and lists of other Society publications issued during the year. These indexes are part of Transactions. Single copies may be ordered by members who desire them. Hence a member can locate any ASME paper printed in MECHANICAL ENGINEERING, Transactions, or *Journal of Applied Mechanics*, and any preprint or manuscript not published by the Society in other form.

What happens to the preprints at the end of the year when storage space must be made available for new preprints? The ASME Publication Sales Department makes every effort to dispose of these preprints in bulk form and at a reduced price. Some are purchased by engineering colleges, for example, for distribution to students. When all these sales efforts have been exhausted, those that remain are sent to the author if he desires to have them.

Service Without Waste

Because of the high degree of specialization which exists in the world today learned societies are constantly faced with the problem of rendering publication services which provide the maximum benefits with the minimum of expense. Few ASME members, if any, have the variety of interests or the necessary time to read all of the papers that are presented at Society meetings. To provide every member with a copy of every paper would either curtail drastically the number and variety of papers printed or necessitate greatly increased expenditures for publication. The first alternative would mean reduced service, and the second unjustifiable waste.

Service without waste is one of the cardinal principles of the policies of the ASME Publications Committee. It was a primary consideration in formulating the 1948 scheme for distribution of Transactions to members by subscription and in the decision to charge a modest fee for preprints of papers. In the years which have elapsed since these changes in ASME practices were put into effect, members' dues have been raised, experience in the operation and cost of the scheme has been acquired, and members' desires and opinions have been studied. Of the many suggestions relating to free copies of preprints the one finally recommended by the Committee and adopted by the Board on Technology and the Council—sending every year to every member free coupons to be exchanged for ten preprints of technical papers presented at National meetings and Division conferences—was most nearly in conformity with the principle of service without waste. It has taken several months to work out reasonable and economical procedures for handling the exchange of free coupons for preprints. Both the Committee and the Secretary's office hope that the policies and procedures developed and explained in the foregoing paragraphs meet with member approval and acceptance. The situation and the steps taken to meet it constitute an excellent example of the adaptability to change possessed by the Society in its attempts to render service without waste.

Management With Automatic Production

Trend Toward Automation Requires Industry to Pave the Way by Developing a New Organization Concept

By Charles E. Knight

Plant Engineer, Plastics Division,
Monsanto Chemical Company, Springfield, Mass.

AT THE outset it is important to define automatic production or "automation." Many present-day plants employ more or less continuous processes with instrumented control and mechanized material handling. However, human decision, or at least surveillance, is required at first-line levels.

In this discussion the automatic factory is considered to consist of one or more continuous product lines completely automatic from raw-material ingestion to finished-product shipment, controlled and monitored by computers. The line will be integrated with functionally designed individual process-step units and related to a range of similar products and capable of computer analysis and control. In other words, the plant will not be built around existing equipment, but means of performing the operations now done by this equipment will be built into the unit. Human effort and decision in production will be confined to the programming and line maintenance level. Men still will be required to feed the proper tape or punch cards into the controlling mechanism and also to adjust and repair mechanical and electrical equipment.

Whether the true automatic factory can evolve from individual specialized components now found in "mass production" or whether it must be designed and built from the ground up is a subject for discussion in itself. For the purpose of this paper the automatic factory here is a glass factory, for instance, designed to produce tumblers of various types where raw-material stock piles are fed in at one end and finished tumblers are emitted at the other, packaged, and ready for shipment.

This will be a custom-built facility, complex in itself internally, but a simple over-all functional unit. Such a unit envisions the need of a mechanical brain and a control computer to aid management in its operations. Shape, size, formulation, color, product rate are programmed into the control computer which, through a system of subordinate computers, feedback, and servomechanisms, executes the orders given. Human effort consists of policy-making, providing the control and forecast computers with information, maintaining the equipment, procuring raw materials, and marketing finished products. In these provinces, however, man's skill must be refined considerably in order to keep pace with the dynamic production organism at his command.

Contributed by the Management Division and presented at a joint session of the Management, Materials Handling, Petroleum, Process Industries, and Production Engineering Divisions, and Research Committee on Metal Processing at the Annual Meeting, New York, N. Y., November 29–December 4, 1953, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Management Functions

In this factory, as in any, it will be the job of management to combine the classical "5 m's"—money, materials, machines, men, and markets—for the profitable production and distribution of a commodity. Management will evolve from a change in emphasis on the phases of its present responsibilities. Under automation, management will face new problems: it will increase emphasis on some present activities, de-emphasize others. Some, separate now, may be combined. Management functions will be modified in the following phases:

Policy-Making. This involves the establishment of the broad doctrines by which the business shall be run and which govern its relationship with society and other industry.

A longer view will be taken at all levels—10 or 15-year programs for profitable use of invested capital will be required at low levels. Markets should be so developed as to minimize seasonal changes, short custom runs. Larger amounts of capital will be ventured on introduction of a new product line.

Advanced Planning. The more detailed preparation for execution of the course set by the policy-making group in terms of markets, raw materials, plant design, location, and personnel.

This will be more complex, take more factors into consideration. Use of a "forecasting" computer is suggested, which, acting on information inputs concerning markets, raw materials, personnel, equipment and maintenance costs, and other known variables, will help predict the company's response to a contemplated course of action, or one already in effect. This sounds Utopian, but some means faster than the human brain must be employed to explore adequately long-term effects of changes in these variables, given the large amount of basic information now available. This type of approach has been employed already by the Armed Services in long-range logistic operations, convoy planning, and attack plans, and may be called "Operations Research."

Financing and Accounting. The procurement and control of funds for operation of the business.

The first will be a function of the top-level men who may prescribe the rate of investment return and distribute funds to the product-line executives. Accounting, as now known, probably will be largely automatic, carried out by machines which will translate information inputs into continuous, up-to-date accounting records. Technicians will be required to feed information and interpret the output. Probably accounting talents will be more and more needed in computer operation and the financing phases of business.

Product Design. Formal conception of an article in demand, or for which demand can be created and which can be made practically and profitably.

Product design must look two ways—at the customer and at the capabilities of the automatic factory. There will be a shift to more functional commodities which lend themselves to automatic production. This approach will encounter consumer resistance in many fields. Product-design people will work more closely than ever with sales and factory-design groups.

The prevalent management form, even in highly mechanized plants, will be one of transition, combining features of conventional organizations with some of those suggested by the author.

Equipment and Factory Design. Formal conception of equipment, buildings, and their arrangement so as to permit safe, economical production of a commodity of satisfactory quality.

Production-line units usually will be designed with the end product in mind and will be integrated with each other. Production of a family of similar commodities will be envisioned. Subject to computer observation and control, the line will be capable of considerable product form change without retooling. The changes may be accomplished by changed orders to the control computer which will make changes in functioning of line components. With automatic material handling and no in-process inventory, buildings should become smaller, more compact—functional. The production labor force as known today will be altered.

Raw-Materials Procurement. The process of establishing and maintaining a supply of starting materials at lowest cost consistent with required quality.

This will require closer scrutiny, longer range. Uninterrupted supply, quality uniformity, form of receipt will be of paramount importance in facilitating carrier-to-line handling, preventing costly delays.

Personnel. The broad field of employment, development, job satisfaction, labor relations, health, safety, and discipline of the human being involved in the manufacturing effort.

Selection and development will assume tremendous importance. More technical background will be required at all levels. There will be fewer but more highly skilled workers per unit output. Training will be longer, more costly; the penalty for failure, higher. In this environment, employee attitudes will change, requiring more attention to incentives. Teamwork will be the watchword—no room for private empires.

Production. The act of making a commodity which conforms with predetermined specifications at minimum unit costs.

Importance of people will diminish, of machines increase. Strict production personnel will be limited to computer technicians programming the line. It will be hard to separate maintenance and material handling from the production activity as it is thought of today.

Sales. The business of marketing the commodity and maintaining good business relations with customers, including technical service.

Like product design, sales should consider capabilities of the factory more than ever in their job. Markets for larger quantities of related products must be developed with seasonal cycles ironed out, small orders co-ordinated to create minimum disturbance to the product organism. Sales activities will be even more closely integrated with production planning and operations. Flow of market information should be more detailed, faster, suitable for input to the forecast computer.

Product Distribution. The activity concerned with movement of the product to customers by the most economical method and with maintaining good relations with carriers and Federal and State legislation concerning product shipment.

This will be about the same as at present with increased co-ordination with sales in moving the finished product—may be included in the sales organization—and with staff functions set up to maintain liaison with legislative groups.

Maintenance. A service group which repairs equipment, engineers improvements, and develops preventive-maintenance schedules to minimize costly unexpected breakdowns.

Maintenance will be mostly preventive, will require more highly trained versatile engineers and craftsmen. The systems engineer will be high in plant councils. Ease of maintenance, standardization, instrumented trouble-shooting will be designed and built into machines.

Controls. Those periodic checks in the form of accounting reports, statistics, and control charts which summarize the cost, quantity, and quality of manufacturing, and associated services.

These will be largely automatic. The computers and business machines which control and monitor the production organism can be made to turn out continuous information on quality, costs, general unit performance. More nearly accurate standards and faster mechanized reporting will be the case.

Communications. The oral and written flow of information throughout the organization.

Communications will be important as never before. Two-way radio, television, public-address systems will move vital information faster. There may be fewer people but they must be more completely quickly informed. "Restricted" information will not help much in the automatic factory.

Co-Ordination. The act of uniting these activities into a smoothly functioning whole.

This must be closer. More people will know each other's business. Teamwork will be all-important with

a minimum of imaginary department lines and vertical reporting.

Organizational Development. The arrangement of the personnel and activity structure so as best to carry out the business effort.

Organization for automation will be simpler in some ways, more complex in others. There may be fewer departments as we now know them. Personnel today considered "staff" (economists, statisticians, engineers, psychologists, training experts, researchers) will be pulled more into the executive line. In addition to increased interdepartmental co-operation at low levels, there must be new problem-solving groups, company-wide and plant-wide, in which engineering, personnel, sales, and production specialists will operate to plot the course of company effort. Although specialists, these men will have authority to act collectively and individually to carry out programs decided upon. The conception, planning, and execution of new programs will be an even greater part of the operating executive's functions.

Management Structure

The exact form of management structure required is open to considerable debate. Experience is limited since there are very few fully automated plants in operation today. To be sure, there are many automatic components operating as part of a conventional factory and here will be found organization changes necessitated by the new operation, but most are combinations of the old and new. Organization for the fully automated push-button factory will look a little strange—may have to be designed, like the plant, as a unit—from the ground up.

Board of Directors. At the top will be a group functioning as does today's board of directors. Raising funds, determining rates of investment return, liaison with stockholders, and selection of product executives will be their province. They perhaps need not include specialists in any phase of company operations other than finance and public relations.

First Problem-Solving Level. The next management level may consist of an executive board made up of heads of each product family unit and the head of the research and product-development group. Armed with composite information from similar groups within their own organizations, they would pool this information, analyze it, and determine the courses to achieve the financial objectives dictated by the senior group.

This is the problem-solving group—company level. It is here that an electronic forecasting computer may be employed as an aid in digesting plans of production and research executives and predicting long-range effects on the company as a whole. This technique may be 75 per cent effective, to the extent that all known variables can be assembled and programmed for input. The effects of changes, conditions within and without the company, can be simulated by altering one or more input variables. Before computer analyses can be employed at this level, mathematical models of the various plants and their interrelationships with the economy as a whole must be constructed in the form of equations which can be built into the computer. Human intuition and creativeness will continue to be exercised where required data are insufficient or of such abstract form that they cannot be reduced to number language.

Research and Product-Development Group. This will be a separate activity at the product-executive level. Receiving market intelligence from product operations-research groups, it will work continually and creatively to evolve new products and improve existing ones. Consideration of new or changed commodities must include the characteristics of the product unit involved. If something looks good enough to warrant consideration of a major change or a new plant, it would be referred to the appropriate product executive for cost and logistic estimates which in turn would be considered, company-wide, at the first problem-solving level.

As at present, research will evaluate new raw materials and competitive products. Where changes seem justified, they will be recommended to the appropriate product executive. More than ever, research and development must be integrated with the total industrial effort. No more "ivory-tower" philosophy.

The Product Family and Plant. Headed by the product executive, the plant organization may be divided into four major groups: Production, marketing, personnel, and operations research.

The heads of these four groups—managers, engineers, superintendents, and the like—will be specialists in their own right but capable of understanding each other's problems and looking at their own job as part of a whole. They will be the problem-solving task force—plant level. Using rapid communications, easy conference-holding facilities, this team will be the staff of the product executive. Equipped with their summarized intelligence and recommendations, the product executive is briefed completely for his contribution to the first-level problem-solving group. While these heads of major plant groups may handle most interdepartmental problems laterally, with a minimum of up-the-line and down operation, they will report to the product executive and be evaluated by him.

Production. The production manager will find his problems mostly of an engineering nature. In the automatic factory it virtually will be impossible to separate the functions of production, maintenance, and material handling. Except for programming the line, production and material handling will consist of maintaining smooth operation of a dynamic but mechanical complex. Production personnel for the most part will be engineers, technicians, and skilled craftsmen. Plant services, matters of maintenance, and material handling will fit into this structure.

Plant design and construction may be too much a part of production to be separated from it. Ease of maintenance must be engineered into new construction. Philosophy and aims of these groups will be too nearly alike to allow separation of departmental lines.

The production manager probably will be a systems engineer, one of a new breed of management personnel. He will be well versed in the fields of feedback-analysis systems, functionally related processes, computer control, but he must be more than a theorist. He should be able to mingle as freely with the technicians in the factory as with the scientists and understand how best to utilize the special skills of his subordinates.

Marketing. The sales or, more properly, marketing manager will find his bailiwick considerably expanded. Need for an accelerated flow of information and interdependence of variables outside the company may create a marketing group composed of nearly all outside liaison

activities. Sales and advertising will require as at present the combination of human intuition, personality, and aggressiveness. The other activities that may be included in the marketing group are purchasing, traffic, shipping, inventory control, receiving, disbursing, and billing. The latter four may be done principally by business machines. Order placement by customers can be on punched cards ready for feeding into production-control computers. More information will be assimilated and decisions made faster. Teamwork will be most important within and without this department. In spite of the varied activities of the marketing group, departmental lines should not block quick interchange of information horizontally rather than vertically. Because of the similar nature of their operations, some of these activities, separate today, may be brought together physically and supervisionwise. Receiving and shipping, inventory control of both finished goods and raw materials are examples of this.

In the normal progress of technological advancement, the adoption of automatic production is a certainity. A greater rate of progress will depend upon the degree of management's understanding and willingness to adapt itself to the needs of automatic production.

The marketing manager primarily will be a sales executive, but with broader perspective than is prevalent today. Besides selling the product, a detailed flow of market information must be returned to plant operations research and company research and product-development groups. The marketing manager probably would have assistants in sales, purchasing (including receiving), traffic, and record control.

Personnel. This department will take on increased significance under automation. In addition to its usual functions of personnel procurement, training, health, and services, it probably will include plant protection, safety, and salary disbursement. While there will be fewer workers per unit output, they will be more highly skilled and require more formal training before going on the job. They will be curious, imaginative—will require more general information on every phase of operations. They will be more conscious of whether you are getting the word around or not. Selection and training will be big jobs. All employees will have the benefit of psychological and aptitude screening tests before hiring. Psychological factors will emphasize teamwork potential and imaginative approach to problems. Results of tests will be used (*a*) in deciding whether to hire, (*b*) in placement after hiring.

Training programs will be co-ordinated by the personnel department and will include considerable classroom work, in and out of the plant. It may be impractical to learn "on the job," even enough to start. For maintenance and service workers, extended apprenticeship training will be required, emphasizing not only special craft skills but also the interrelation of craft problems in the particular process involved. In general, fewer employees will be able to handle their jobs immediately after hiring. High cost of initial training, as such, must be accepted. Thus it will be imperative to screen prospective employees with good test batteries slanted at specific operations.

Tomorow's personnel manager conceivably will develop from today's, with more responsibilities and greater perspective. He must know more about the plant and will devote most of his energies to employee selection and training. His staff may include a psychologist, a sociologist, and a trained educator.

Operations Research

Although the last to be treated here, this activity probably will be the first department of the new organization to be formed and will spearhead the transition from today's modern factory to the truly automatic one. Operations research is simply "systematic scientific investigation of business problems by a group of men highly trained in the methods of thinking, developed in exploring the physical sciences."[1]

Probability theory and statistical analysis are common in business control today and will be employed to construct mathematical models or equations for the industry, plant, and process which provide bases for optimum performance of the integrated computer-controlled manufacturing process.

Information-gathering from many sources and its evaluation will be of primary concern to this group. Marketing information, buying habits, trends in government spending and requirements, as well as qualitative and quantitative process performance, personnel availability, and health and accident conditions will find their way to this group. Computer analysis will assist in preparing these data for use in construction and operation of the automatic factory and predicting its response to internal and external stimuli.

Since operations research will require access to nearly all plant records, it seems logical to have it provide the accounting and other business-control services now requiring statistical analysis and reporting. Development of faster communication systems to handle the vast amount of detail will be done by this group which will serve the entire plant by creating "pipe lines" with the right outlets for the right people. Teletype, closed-circuit television, automatic remote recording, and two-way radio will be tools of the communication section, in addition to conventional correspondence and telephone contacts.

Operations research may be headed by a servoscientist with assistants for computer theory, communications, and accounting. More than any other man in the organization, the operations-research manager must maintain fast contact with other departments, insuring that a maximum of detail is funneled into his group automatically in the best form for analysis.

The Product Executive

The product executives, each of whom heads an organization as described, will be the most important cogs

(*Continued on page 355*)

[1] "Automation—Challenge to Management," by M. D. Moross, et al., Harvard University Graduate School of Business Administration, 1953, p. 46.

Using Optical Measurements in Engineering

High-Precision Optical Instruments Developed for Wide Industrial Application

By Nisson A. Finkelstein

Bausch & Lomb Optical Company, Rochester, N. Y.

A REVIEW of the means by which optics is used for engineering measurements is quite a fascinating task for many reasons, among which are the ubiquitous character of optics in the various engineering professions as well as the long-standing prior claim of the human eye, an optical instrument of exceptionally fine manufacture, to the title of first measuring instrument.

One somewhat arbitrarily can divide all optical instruments into two classes; those in which light is used as a tool and those in which light is used as a metric, a fundamental unit of measurement, or a reference axis.

Under the first class we can list instruments for measurement by magnification, measurement by photometry, measurement by analysis of emitted radiation, measurement by response to incident radiation, measurement by illumination and signal communication. Under the second class we include instruments operating on the principle of interferometry and those operating on the principle of collimation and autocollimation. We shall consider each of these optical-instrument categories briefly in terms of operating principles, theoretical and practical limitations, and typical representative devices.

Measurement by Magnification

Probably the most well-known and widely used group of optical instruments are those which make measurement possible through magnification. Their primary function is to produce an enlarged image of a small object or portion of an object for purposes of identification, dimensional measurement, or location determination. Instruments in this group include simple hand magnifiers, Fig. 1, microscopes (which can really be thought of as compound magnifying glasses), and contour projectors. Telescopes probably also should be included in the group, since, although they do not magnify in the usual sense, they do make the distant appear near, a function akin to magnification.

In all these magnifying instruments the ultimate goal is seldom magnification alone, but rather magnification with increased clarity of detail. We wish to enlarge the object to gain more information about it; hence the concept of "maximum useful magnification," that value of magnification above which no increased information concerning the object can be obtained. The maximum useful magnification of an optical instrument is dependent on the "resolving limit" of the instrument, the smallest distance between two points for which the

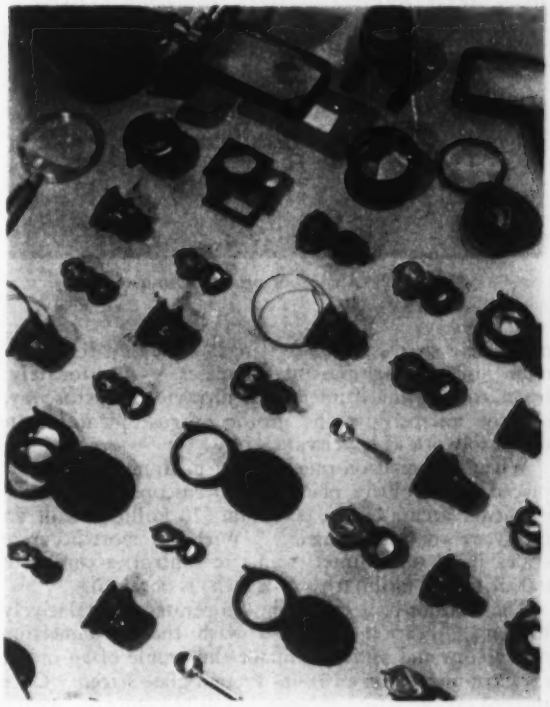


Fig. 1 A representative assortment of simple magnifiers

points are recognizable as discrete and separate; that is, if the unaided eye of an observer has a comfortable resolving limit of 300 μ (0.012 in.) and a high-quality oil-immersion microscope objective a limit of 0.25 micron (0.00001 in.), then the maximum useful magnification obtainable by the observer from the microscope is approximately 1200×. A magnification of 2000× will yield no increase in information. Expressed as an equation

$$\text{Max useful mag} = \frac{\text{Resolving limit of unaided eye}}{\text{Resolving limit of microscope}} \approx \frac{300 \text{ microns}}{0.61\ \lambda/\text{NA}}$$

where λ is the wave length of light passing through the microscope and NA is the numerical aperture. The equation is only an approximation because of varying conditions of observation and lens quality. It can be

Contributed by the ASME Rochester Section and presented at the Fall Meeting, Rochester, N. Y., October 5–7, 1953, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Fig. 2 A contour projector in use

noted here that as the wave length decreases, the maximum useful magnification increases proportionately; hence the continued interest in ultraviolet microscopy, electron microscopy, and proton microscopy in an attempt to work at lower values of λ.

When a precision-ruled stage micrometer scale is placed in the object plane of a microscope, linear measurements accurate to 0.0005 mm (20 millionths of an inch) are routinely possible. With the most accurate scales ruled under interferometric control, accuracy of 0.0001 mm (4 millionths of an inch) is obtained.

The contour projector, Fig. 2, operates at a relatively low magnification compared with the oil-immersion microscope and serves to image the profile of an object for examination on an 18-in. ground-glass screen. Once imaged on the screen the profile can be compared with a scaled-up tracing and, if desired, the departures of the projected part from desired dimensions can be determined accurately.

On contour projectors commercially available, a series of magnifications between 10× and 100× usually are provided. Dimensions can be read on the screen to an accuracy on the order of 50 to 100 millionths in., figures which compare quite favorably with the 300 to 500-microinch accuracy available using a micrometer caliper. The important design consideration in instruments of this type is freedom from distortion over the full area of the screen, as well as uniform and ample brightness of imagery. Since magnifications greater than 100× are used rarely, the resolving limit of the optics is not a problem in this type of device. Of recent years the use of the contour projector, or profile comparator, has been spreading rapidly in both this country and England.

Measurement by Photometry

Optical instruments using photometry are all based on an intensity comparison between the radiation incident on a volume and the radiation transmitted, scattered, or fluoresced by that volume. The photometric approach forms the basis of devices for measurement of turbidity, haze, visibility, foreign-body impurity, and smoke content. We are concerned here with the ability of the eye or electronic system serving as the detecting element to measure intensity differences. When the light intensities are on the order of microlumens or less, this often reduces to a problem in signal-to-noise ratio.

As an example of what is possible, consider the experiment in which a powerful searchlight is played on a volume of air and a measurement made of the quantity of radiation scattered by the particles of air back to the source. With a source of 20,000 lumens intensity, backscattering on the order of 2 microlumens can be determined to an accuracy of ± 1 per cent with suitable electronic equipment, a 1 per cent measurement at an intensity ratio of 10 billion to 1!

Measurement by Analysis of Emitted Radiation

Falling under this category are the emission spectrograph, flame photometer, fluorometer, nuclear-scintillation detector, and the optical pyrometer.

Emission spectrography is based on the phenomenon of characteristic spectral emission under conditions of atomic excitation. Because each element in the chemical periodic table has a distinctive and unique electron structure, the wave lengths of light emitted by atoms under excitation are characteristic "fingerprints" of these atoms. The spectrum of zinc is recognizable as distinct

Fig. 3 Typical spectroscopic "fingerprints"; (*a*) zinc, (*b*) cadmium, (*c*) lead, and (*d*) iron

from that of all elements, for example; even if the zinc is mixed in with many other elements, see Fig. 3.

A spectrograph is a device which spreads the light emitted by a substance burned in an arc or spark into an orderly rainbow of its component wave lengths. If a sample of a steel alloy is to be analyzed for its composition, it can be used as one electrode in an arc or spark, and the light from this source dispersed wave-lengthwise in a spectrograph. Then the resultant spectrum will contain the fingerprint spectra of each of the alloying elements as well as that of iron, and an analysis of composition can be accomplished. By this technique it is possible to obtain many times the speed and accuracy of classical wet-chemical analysis, and spectrochemical analysis now plays a leading role in the major industries of this country, often detecting impurities present in amounts on the order of 1 part per million.

Flame photometry is a special kind of emission spectroscopy in which characteristic spectral emissions are excited in a hot gas flame and the intensity of certain emission lines and bands observed visually or photoelectrically. Because of its simplicity and accuracy, particularly for the alkali metals, the application of flame photometry to industrial analysis problems has been extensive. The limitation of the method is in the relatively low level of excitation possible even in a hot oxyacetylene flame.

The technique of fluorimetry is based on the principle that the concentration of a substance which fluoresces in solution when irradiated with ultraviolet light may be determined by measurement of the intensity of the fluorescent light. The source of excitation is usually the strong 3650A line of mercury and filters are used throughout the optical system to minimize the effects of stray visible and ultraviolet light in the fluorescence readings. The fluorescence spectrum of a substance provides a fingerprint similar in nature to that utilized in flame photometry and emission spectroscopy.

A relatively recent and exotic example of measurement by analysis of emitted radiation is that of the nuclear-scintillation counter in which the energy and intensity of nuclear beta-ray emissions are obtained through measurement of the visible scintillation light produced when beta rays impinge on so mundane a material as crushed moth balls. Thus a simple, efficient, and inexpensive beta-ray detector is made by surrounding the sample under study with moth balls and observing the scintillations with a photomultiplier tube.

Finally, we should mention the use of optics for temperature measurement in which the temperature of a hot body or mixture is determined from its color. Probably one of the most well-known applications of optics, this technique is useful in the temperature range 1000 to 5000 F and maintains an accuracy on the order of ±5 F. The physical principle involved in optical pyrometry is that relating the temperature of a hot body to the wave lengths of radiation emitted by the body at this temperature.

Measurement by Response to Incident Radiation

In this category light is used as a test probe and we are interested in determining the effect of our sample under test on this probing bundle of rays. An excellent example of "light probing" is found in spectrophotometry, that technique in which the transmission or reflectance of a material is determined as a function of wave length. The sample is placed in the path of a beam of collimated monochromatic radiation and as the wave length of this radiation is varied, the intensity of transmitted (or reflected) radiation is measured, usually with a photomultiplier and electronic amplifiers.

Spectrophotometry is used today in such diverse applications as the monitoring of chemical processes, the control of color in shoe boxes and cigar wrappings, the measurement of reflectance of living human skin, and the analysis of synthetic vitamins.

Colorimetry, a simplified form of spectrophotometry

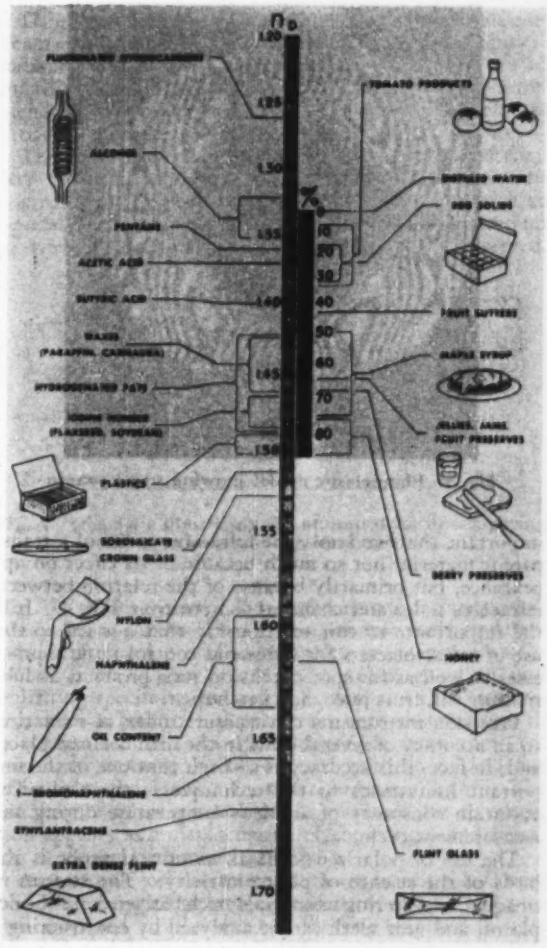


Fig. 4 Refractive index range of some common materials

in which the radiation employed for probing is less purely monochromatic, is now almost universally used in hospitals for blood analysis, bile analysis, and the like. With modern equipment it is possible to obtain a spectrophotometric or colorimetric curve over the entire visible region of the spectrum in a matter of a few minutes and to obtain this curve with an accuracy of 1 per cent or better.

A less well-known technique of "optical probing" is the measurement of gloss, but several instruments for

performing this function are commercially available and gloss measurement at various angles of illumination and observation rapidly is becoming an important operation in the paper industry and the paint industry, for example. Gloss control is a factor almost comparable in importance to color control in the quest for standardization of "how things look."

Refractometry, as the name implies, is the measurement of index of refraction. It usually is accomplished by observing the deviation undergone by a probing light beam in passing through an unknown material. It is

Fig. 5 Photoelastic model showing stress pattern

important that we know the refractive index of a transparent material not so much because of its effect on appearance, but primarily because of the relation between refractive index and chemical composition, Fig. 4. It is the importance of this relationship that has led to the use of refractometers for industrial control in flow processes as well as for spot checks on such products as lubricating oil, fruit juice, and ketchup.

Precision instruments can measure index of refraction to an accuracy of several units in the fifth decimal place; and, in fact, this accuracy is so high that one of the important limitations to the technique is the ability to maintain constancy of ambient temperature during the measurement cycle.

The use of polarized light as an optical probe is the basis of the science of photoelasticity. The stresses in opaque engineering materials such as girders, boiler plates, and gear teeth can be analyzed by constructing a transparent model of the object (out of bakelite, for example) and examining it under polarized light as viewed through crossed polarizing elements. Substances such as bakelite, glass, and celluloid become doubly refracting when subjected to mechanical stress and this technique of photoelasticity can be applied to reveal stress patterns of such a complicated nature that mathematical analysis is practically impossible, Fig. 5.

Measurement of Illumination

We do not commonly think of illumination as a branch of optics which has much applicability to engineering measurements, and yet the stroboscope employs controlled intermittent illumination to study the motion of rotating and reciprocating parts of machinery. Because of the persistence effect in human vision, a light flash operating at frequencies greater than 16 cycles per sec (cps) appears to supply continuous steady illumination. Now, if the frequency of the light flash is adjusted to equal the frequency of rotation of a drive shaft, for example, then the shaft will be illuminated every time it occupies precisely the same orientation in space. Hence it will appear to stand still. If the frequency of flashing is somewhat too high, the shaft will appear to be rotating slowly backward; if too low, the slow rotation will appear to be in the forward direction.

Here we have a powerful and highly accurate technique for measurement of rotational and reciprocating velocities without any loading of the mechanism. Stroboscopy is also applicable to the study of velocity drift in rotating systems and to the observation of fracture due to centrifugal force. With the electronic equipment available today the maximum frequency of flashing is approximately 500 cps. In commercial stroboscopes provision is usually made for controlling the flash frequency from an external source as well as internally.

Besides stroboscopy we can include phase contrast and dark-field illumination as aids to measurement, both in the field of microscopy. Through each of these techniques it is possible to lend contrast to a specimen under observation which would appear without detail under conventional illumination. The value of phase contrast alone in eliminating, in some cases, the necessity for staining specimens has been tremendous. For example, in citrus-fruits industries concerned with canning orange juice the time saved by phase-contrast illumination over the old staining technique in control tests has meant the saving of many vats which otherwise would have spoiled in the delay. Again, in analysis for insolubles in crankcase oils more positive identification through phase contrast has meant savings in time and money.

Signal Communication

The next group of instruments, those for signal communication, is composed of optical devices which detect or transmit signals. The first members of this group, photography and photoelectric devices, are really the property of the chemist and the electronics man, respectively, rather than the optical engineer; but since they both deal with photons in their operation perhaps we can usurp some of the credit in our discussion.

The design of electrically controlled light valves usually is based on the phenomenon of double refraction. Certain liquids, for example, are not normally double-refracting but become so in the presence of a strong electric field. If one of these liquids is placed in a transparent cell and the cell inserted between a polarizer and an analyzer, then light will be transmitted when an electric field is established within the cell and shut off when the field is turned off. Recently this same kind of light valve has been made using crystals of ADP (ammonium dihydrogen phosphate), thereby eliminating the complications of the messy and often dangerous Kerr-cell liquids. In the near future the applications of this inertialess on-off switch for light doubtless will grow at a rapid rate.

Finally, under devices for transmitting light signals we must list the periscope, that mystifying instrument for seeing around corners. It is rather impressive to note how many contemporary engineering problems of remote indication which could be quite simply solved by an optical periscope system have been treated with complex and expensive instrumentation. As an example we can cite the laboratory in which it was necessary to read a meter on top of a 20-ft-high van de Graaff generator, and in which a $5500 television transmitter and receiver were used for the job when $50 worth of optics would have done as well and doubtless given greater resolving power.

Measurement by Interferometry

All of the applications of optical measurements in engineering which we have discussed thus far are based on the use of light as a tool. One of the most important and interesting group of applications is that in which the wave length of light is used as a fundamental metric or unit of measurement.

The whole idea of establishing fundamental units of length by some natural physical standard has long attracted physicists. In 1792 the original meter standard was intended to represent one ten-millionth of a meridional quadrant of the earth. In Great Britain the Weights and Measures Act of 1824 defined the yard in terms of the length of a pendulum beating seconds at sea level in London. As early as 1829 Babinet suggested the use of a wave length of light as a natural standard of length and this step was later urged by Fizeau and Gould in the second half of the nineteenth century. Michelson in this country suggested the red line of cadmium in 1896, as the best primary standard and measured its wave length in terms of the meter.

Finally, in 1922, the International Astronomical Union defined the angstrom unit in terms of the wave length of the red cadmium line. Provisional sanction to the measurement of length in wave lengths of the red-cadmium line was given in 1927 by the Seventh General Conference on Weights and Measures. More recently the use of one of the sharp spectral lines emitted by a single isotope of mercury has been suggested as a refinement over the cadmium line.

The instrument which makes it possible to use a wave length of light as a unit of length is the interferometer, a device which is based on the phenomena of constructive and destructive interference. If two waves arrive at a point in such a manner that their wave motions are in phase they combine to produce a bright band or fringe. Alternatively, if they arrive out of phase, destructive interference will take place, they will cancel each other, and a dark fringe will be produced. Thus a difference in optical path traveled equal to any integral number of wave lengths produces constructive interference while differences of $\lambda/2$, $3\lambda/2$, $5\lambda/2$, and so on, produce destructive interference.

If we consider the case of two thin reflecting films oriented to form a wedge, we note that a series of alternate light and dark fringes will appear as the separation between the films changes by quarter-wave steps (each quarter-wave change in spacing produces a total of half a wave-path difference). Thus a measure of the separation between fringes determines the angle of the wedge.

In most applications of interferometry an ideal surface is compared with the surface under test and the departures from the ideal measured in terms of interference fringes observed.

It is interesting at this point to compare the accuracy obtainable with gage blocks or slip gages with that possible using interferometry. A so-called "workshop-quality" gage block is accurate to approximately 10 microinches, or 1 fringe of green light. An "inspection-quality" block is reliable to about $^2/_3$ fringe, a "calibration" block to $^1/_2$ fringe, and the best "reference" blocks to about $^1/_5$ fringe. Interferometric surface tests can be routinely read to $^1/_4$ fringe and with some care to $^1/_{10}$ fringe.

Using a somewhat more complex system, the multiple-beam interference technique introduced by Tolansky, measurements have been made to $^1/_{50}$ fringe, or 0.2 microinches. Needless to say, in surface testing a tremendous advantage accrues to the interferometric approach in that the entire surface can be tested at once.

There are many fascinating applications of interferometry in engineering measurements, among them the comparison of a gage block with its master, in which an optical flat is placed across the two blocks and the amount of wedge measured in terms of the fringes observed,

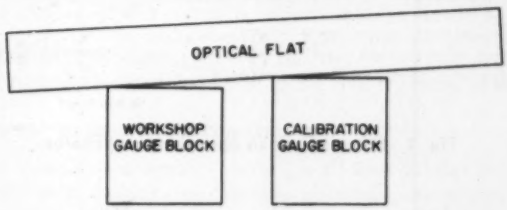


Fig. 6 Schematic illustrating use of optical flat in comparing gage block with its master

Fig. 6. More recently an interferometric technique has been used at the National Bureau of Standards to detect corrosion to a depth of as little as 1 or 2 ten millionths of an inch. Their procedure involves grinding and polishing specimens to optical flatness and then immersing them to half their depth in the corrosive solution in question. After a specified length of time they are withdrawn, rinsed, dried, covered with an optical flat of quartz, and viewed in monochromatic light. The swelling of the lower half of the specimen due to corrosion appears as a displacement of the fringes and hence can be determined quantitatively.

An example of the tremendous engineering accuracy possible through the use of interference testing and control is found in the several dividing engines in this country for ruling optical diffraction gratings. Diffraction gratings are used to disperse light into a spectrum of wave lengths and form the heart of many of our modern instruments for spectrochemical analysis. They consist of an optically flat piece of glass coated with a highly reflecting layer of aluminum and ruled with many thousand grooves, usually between 15,000 and 50,000 grooves per in. Each of these grooves must be formed accurately and located correctly with respect to each other groove of the grating to an accuracy of one millionth of an inch. Thus a ruling engine may, in a typical assignment, have to rule 100,000 grooves with millionth-of-an-inch accuracy. Interferometry plays a

key part in the successful performance of this task including the proper setting of the ruling diamond, the examination of test grooves for depth and width, the calibration of the lead screw, the design of correction cams, and so on.

Measurement by Collimation and Autocollimation

The final category of optical instruments is that of optical straightedges. Here we can list such instruments as the optical level, the surveying transit, and autocollimating systems. They are all based on the fact that light travels in a straight line, and that the straightness of this line is well beyond that achievable in any mechanical system.

The optical level is simply a telescope mounted on a machinist's spirit level, but it is possible with this elementary tool to level or align points separated by several hundred yards and to do it with an accuracy measured in hundredths of an inch. During the last war such telescopes were used extensively in the aircraft assembly lines to align wings and fusilages.

The action of an optical autocollimator is illustrated in Fig. 7. A light source illuminates a slit or graticle

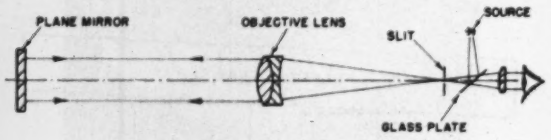


Fig. 7 Schematic of an optical autocollimator

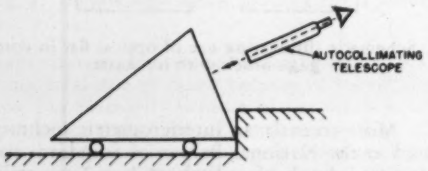


Fig. 8 Schematic illustrating use of an autocollimator for checking prism angles

and the rays from this slit are collimated by an objective lens. If this collimated beam is intercepted by a plane mirror oriented perpendicular to the optical axis, then the light rays are reflected back upon their original paths and re-entering the telescope form an image of the slit coincident with the slit itself. Most of this reflected light passes through the glass plate and enters the eye of the observer who sees only one image of the slit. On the other hand, if the plane mirror is inclined at an angle θ to its normal position the reflected rays are returned at an angle 2θ relative to the incident rays, and the image of the slit is now displaced from the actual position of the slit. By measuring this displacement the angle θ can be determined or, alternatively, the mirror can be brought into its normal position by tilting it until the two slit images coincide.

A typical example of the use of autocollimators is in checking the face angles of machined parts relative to some reference plane in the part. For a simple prismatic part, Fig. 8, the master prism is mounted with a three-point location of the reference face and the collimator aligned to read zero. Each unit to be checked is then placed on the test jig and the difference from the master angle is read on the collimator.

Other autocollimator applications are in the checking of circular tables or dividing heads, checking departure from parallelism on the frictional surfaces of a machine tool, and checking straightness and squareness. As in the case of the telesopé level and surveyor's transit, the accuracy of measurements made with an autocollimator is independent of distance up to the point where visibility is impaired.

Conclusion

Having covered in a somewhat cursory and peremptory manner some of the uses of optical measurements in engineering, we can close by emphasizing the advantages of optics as a tool in engineering: (1) Optics has the characteristic of rectilinear transmission—light rays in a homogeneous medium always travel in straight lines, which can be considered for all practical purposes "perfectly" straight lines. (2) Light has none of the inertial or space-requiring properties of gross matter—an optical straight edge 1000 ft long can be stored in a broom closet and carried under one arm. (3) The wave length of light in vacuum is a fundamental constant, unaffected by geography or time, immortal as the universe. (4) Optical measurements do not destroy or mar the material under measurement.

For these reasons as well as many others we believe that optical measurements will continue to play an ever-expanding and important part in engineering progress.

In many respects, the last 300 years of man were not so different from any other 300 years; there were wars, empires rose and fell, literature and masterpieces of art were created. But in one respect this period was different. It saw the development of science. Somehow men found the right approach, and suddenly within only ten or so generations an edifice of human understanding of the mysteries of nature has developed, which has shed light into dark abysses of guesswork and superstition. Of course, this has brought about a mastery of nature as never before. It has led to a longer life span for men and has brought about many other changes which make our planet at present look very different from before. This point has been emphasized many times. What needs more emphasis, however, are the intellectual values, the new insights, the great perspectives, the all-embracing ideas which science has created. Concepts like Darwin's evolutionary theory, in which the development of species can be understood on the basis of casuality; concepts like the electromagnetic field, which is the basis of all electric, magnetic, and optical phenomena; the mechanism of genetics, which explains the constancy of the variety in the living world; Einstein's relativity theory; the intricate web of ideas in quantum theory, which gives a fundamental understanding of almost all properties of matter on the basis of electromagnetic forces within the atom. These concepts give us a much more profound view of certain aspects of our world than we ever had before.—From a paper presented at the 1953 annual meeting of the American Association for the Advancement of Science, by V. F. Weisskopf, professor of physics, Massachusetts Institute of Technology, Cambridge, Mass.

Relating Sawmill "Waste" to Log Quality

What the Small Sawmill Is Doing to Improve Methods and Minimize Waste

By Fred C. Simmons[1]

Northeastern Forest Experiment Station, Upper Darby, Pa.

THE TERM "waste" has become unpopular among lumbermen. They resent the implication that they are wasteful in converting round and rough logs to the rectangular shapes demanded by users of lumber and timbers. Some leftovers are unavoidable in such a process. Many efforts have been made to find a more acceptable term. "Unutilized wood" and "mill residues" are two terms that have been proposed, but both are awkward and have not gained wide acceptance.

Finding Uses for Sawmill Leftovers

To an increasing degree none of these terms is really applicable. The use of these sawmill leftovers for purposes other than lumber has been increasing rapidly, particularly in recent years. More than 200 uses have been found for the sawdust and shavings developed at sawmills in the Northeast. The most sizable one is for agriculture, i.e., bedding for livestock, mulch, and soil conditioner. This is, of course, a low-priced market. Sawdust is being used in snow-tire manufacture, in plastics, in composition-floor production, in optical-goods polishing and in many widely varied products.

Slabs and edgings also are finding more markets than formerly. The traditional use as fuel is decreasing, but it is still important. Equipment for resawing slabs and edgings to make squares and bars for wood-turning and toy plants, boxes and crates, tobacco stakes, and even furniture dimension, is becoming common. Considerable quantities of raw wood chips from slabs and edgings developed at sawmills in western Pennsylvania and New York, Ohio, and West Virginia are used in the electrometallurgical industry, in place of charcoal. The fast developing small-kiln charcoal industry is primarily dependent on slabs and edgings as a source of raw material. And methods for making uniform, clean, and bark-free chips from sawmill slabs and edgings as a suitable raw material for the pulp-and-paper industry are rapidly being developed.

Yet, in spite of the increasing markets for his leftovers, the sawmill man is usually interested in getting as much as possible of his log supply into his primary product—lumber. It is good business for him to do so.

Working against this is the generally decreasing quality of logs available to the small-sawmill man in all parts of the country. Even in the Douglas-fir mills on the West Coast nearly one third of the log supply is now coming from second-growth stands. In the white-pine mills of the North and the yellow-pine mills of the South old-growth logs of good size have practically faded to a memory, and many sawmills are subsisting on logs averaging only 8 or 10 in. diam—and bumpy and crooked ones at that!

Hardwood stands generally have not been cut so heavily, and diameters of the logs received have not decreased so markedly; but the quality of hardwood logs coming to the sawmills is deteriorating steadily in all the major producing regions. Rot, crook and sweep, shake, and split are common in the logs on the mill deck of almost every hardwood mill in the country these days.

"Waste" in Relation to Log Quality

In this paper, sawmill "waste" is all material not converted into lumber or timbers, although, as already mentioned, much of this is being used profitably for other purposes. The amount of this "waste" developed at sawmills will vary with the equipment used and the sizes of the lumber made.

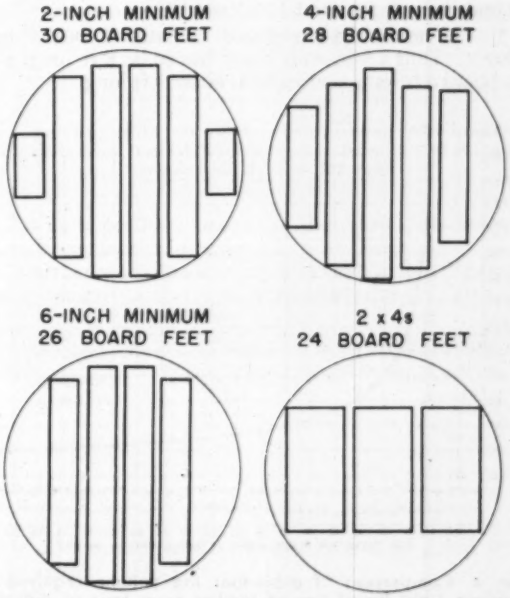


Fig. 1 Relative amounts of lumber of different dimensions that can be sawed out of an 8-in. × 12-ft log

[1] Specialist in Logging and Primary Processing, Forest Service, U. S. Department of Agriculture.

Contributed by the Wood Industries Division and presented at the Annual Meeting, New York, N. Y., November 29–December 4, 1953, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS; condensed from Paper No. 53—A-197.

The thinner the saw used, the smaller the amount of sawdust developed. The more accurate the cutting, the less the allowance needed for later processing at the planer.

In addition to the quality of the sawing, the lengths, widths, and thicknesses of lumber produced affect the percentages of waste products. The mill making narrow and thin lumber from the exterior of small logs can reduce materially the amount of slabs and edgings. Cutting to odd-inch widths, as is common in white-pine mills, or to completely random widths, as is the practice with hardwoods, instead of only to even-inch widths, will reduce further the amount of edgings. More volume can be made from tapered logs if short lumber is manufactured from them. Cutting a high percentage of thick stock reduces the amounts of sawdust produced. This is graphically illustrated in Fig. 1, which shows the number of board feet obtainable from an 8-in. log with four different methods of sawing.

Log Rules Used in Calculations

To compare accurately the amounts of mill leftovers produced from logs of various qualities, it is necessary to assume comparable sawing practice and products. This has been done by the makers of the better log rules, which are designed to give the board-foot content of logs of various sizes and descriptions One of the more accurate of these rules for conditions prevailing at small mills in the eastern United States is the International $^1/_4$-in. rule, devised by Prof. Judson H. Clark of the Ontario Department of Lands and Forests in the early 1900's.

This rule, which was based on extensive tests at sawmills, is founded on the following assumptions:

1 The entire log is sawed into $^4/_4$ lumber.

2 The saw kerf is $^1/_4$ in., and in addition $^1/_{16}$ in. is allowed for shrinkage and variations in sawing. (This latter allowance is inadequate for small mills sawing second-growth material.)

3 The minimum-size board contains 2 board feet (fbm). Thus a 3-in-wide board has to be 8 ft long, a 4-in. board 6 ft long, and an 8-in. board 4 ft long.

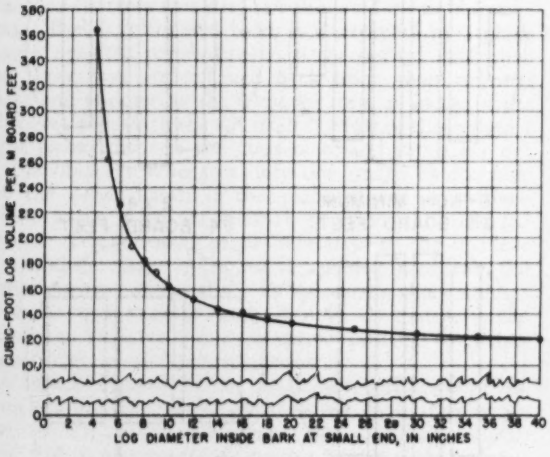


Fig. 2 Comparison of cubic-foot log volume required to produce 1000 board feet of lumber from logs of different sizes. This comparison is based on 16-ft logs, volumes scaled according to International $^1/_4$-in. log rule.

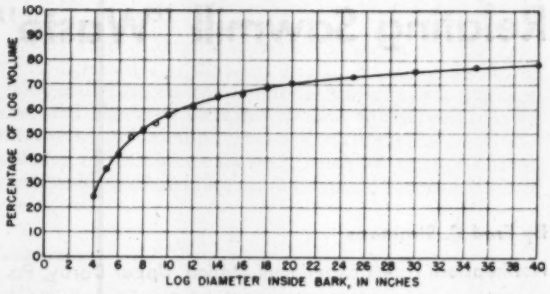


Fig. 3 Percentages of total log volume converted to lumber from logs of different sizes. This comparison also is based on 16-ft logs, scaled according to International $^1/_4$-in. log rule.

4 An allowance is made for "normal crook" in the logs, which in the "first-class" logs studied was found to average 1.5 in.

5 A taper of $^1/_2$ in. in each 4 ft of length also is allowed for.

One can take the values given in this rule for a given log length and compare them with the calculated cubic volumes of the same logs, and from these figures derive the number of cubic feet of log volume required to produce 1000 fbm of lumber for first-class logs of various sizes. This has been done for 16-ft logs in Table 1. The ratios developed are shown graphically in Fig. 2.

Table 1 Board Foot-Cubic Foot Ratio for 16-Ft Logs

Diameter inside bark, small end, in.	Board feet (International $^1/_4$-in. rule)	Cu ft (Huber's formula)	Cu ft per 1000 fbm
4	6	2.18	364
5	12	3.14	262
6	19	4.27	226
7	28	5.58	193
8	39	7.07	182
9	51	8.72	173
10	65	10.56	162
12	97	14.75	152
14	136	19.63	144
16	181	25.22	141
18	232	31.50	136
20	290	38.48	133
25	462	59.04	128
30	674	83.84	124
35	925	113.00	122
40	1220	146.69	120

The same data were used to calculate the percentages of the total cubic contents of logs of the different diameters that could be converted to lumber, as shown in Fig. 3.

These data indicate that log size is tremendously important in the amount of mill leftovers developed for a given method of sawing. For example, in logs with a 4-in. top diameter, 364 cu ft of log volume have to be brought to the sawmill to produce 1000 fbm of lumber with a nominal volume of $83^1/_3$ cu ft.

From 12-in. logs, in contrast, 62 per cent of the total cubic volume can be converted to lumber. Above 12 in. the increase in utility of the logs with increasing diameter is very much slower, with a 24-in. log calculated to be capable of yielding 73 per cent of its total cubic volume in lumber.

These values, it must be remembered, are for first-class logs as recognized back in about 1910. Any cull, including excessive crook and sweep, shake or split, dote or rot, worm holes, or just plain bumpiness, will add to the proportion of the total cubic volume of material going into the waste pile.

Effect of Cull

Scale deductions for such defects are ordinarily not very large for second-growth softwoods, which typically contain relatively little rot and are apt to be reasonably straight. But the remaining old-growth softwoods throughout the country frequently contain considerable amounts of red heart rot, or, in the case of the Douglas-fir stands near the Oregon-California border, considerable white-speck rot. Some of these latter stands contain as much as 60 per cent cull material. Old-growth hemlock in the East is apt to be full of shake.

Hardwoods, on the other hand, typically contain much cull, in both old and second-growth stands. Some species of hardwood—second growth beech for example—are so crooked that many trees are just plain unmerchantable by any standard method of sawing. Because of their thin bark, lack of pitch to cover up wounds, and susceptibility to top injuries, some hardwoods are easily wounded by damage incidental to logging operations, and from wind and glaze storms; they contain rot at a relatively early age. It is not uncommon for the logs brought to the mill to run as high as 20 to 30 per cent cull.

Professor Clark has given his formulas for the volumes of sawdust, slabs, and edgings developed in the process of sawing logs of different diameters. These formulas have been used in calculating the values shown in Fig. 4. This indicates that the greatest proportion of mill leftovers on small logs is composed of slabs and edgings, and that sawdust constitutes a smaller portion of the total. At about 14 in. the quantities are about equal, and above that diameter the amount of wood lost in slabs and edgings is less than that going into the sawdust pile.

Some Mill Studies

Practically no empirical studies have been made in the United States to show the relationship of mill leftovers to log qualities. Large logs and small logs, crooked logs and straight logs, sound logs and rotten logs, usually are sawed differently, and different sizes and types of products obtained. Low-grade material ordinarily is shoved through the mill as rapidly as possible, with less attention to obtaining the maximum yield of product. High-grade logs are handled more carefully.

Nevertheless, the results obtained in a number of recent studies of mill residues do reflect the effect of log quality, particularly log size, on the amount of mill residues produced.

In 1948 to 1950, for example, the Southern Forest Experiment Station of the U. S. Forest Service made a study of the amount of chippable waste produced at a number of pine sawmills in the South. Results are reported[2] in terms of "cords" per 1000 fbm sawed (each "cord" being 2500 lb, oven-dry weight, of solid wood). Four different types of sawmills were recognized, based on size and equipment used. In general, however, the size of the log sawed proved to be more important than the type of equipment used. Translated into the terms used in this paper (cubic feet of solid green wood waste per 1000 fbm of lumber sawed) the average results are given in Table 2.

Table 2 Results of Chippable-Waste Study

Log-diameter group, in.	Chippable waste, cu ft
8	80.5
11	50.0
14	38.6
17	32.5
20	29.1
23	26.0

When these values are compared to those given for slabs and edgings in Fig. 4, it will be seen that they are 10 to 20 cu ft per 1000 more than the allowances made for such waste by the International $^1/_4$-in. log rule.

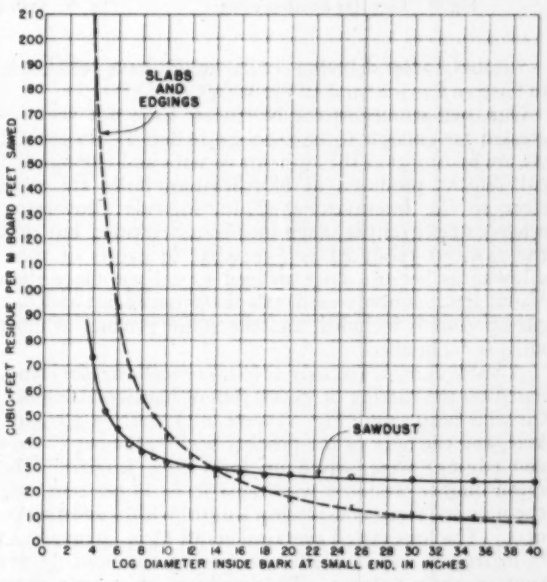


Fig. 4 Theoretical mill residues from sawing 1000 board feet of lumber from logs of different sizes. Based on 16-ft log and International $^1/_4$-in. log rule.

Another study made in East Texas sawmills[3] gave results somewhat closer to the International $^1/_4$-in. log-rule allowances, when converted to solid green wood equivalent (Table 3).

Table 3 Results of Waste Study, East Texas Mills

Log-diameter group, in.	Slabs, edgings, trim, cu ft, per Mbf	Sawdust, cu ft, per Mbf
8	54	31
11	42	29
14	33	28
17	28	28
20	24	28

[2] "Amount of Chippable Waste at Southern Pine Sawmills," by R. D. Carpenter, Southern Forest Experiment Station Occas. Paper 115, 1950, 7 pp.

[3] "Survey of Sawmill Residues in East Texas," by W. W. King, Texas Forest Service Technical Report 3, 1952, 59 pp., illus.

Fig. 5 Circular head-sawing

Fig. 6 Sash-gang sawmill

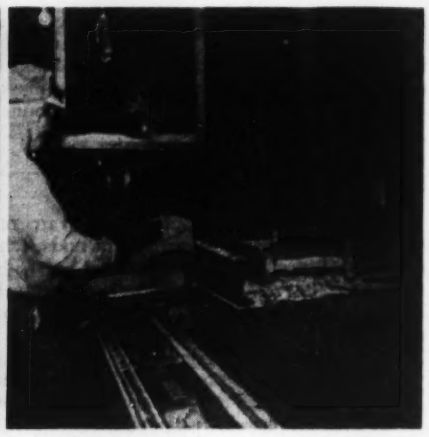


Fig. 7 New England short-log bolter

Similar studies showing similar trends have been made in Eastern Canada[4] and on the West Coast.[5]

Our own studies in the Northeast have not yet progressed far enough to be reported in detail. In general we are finding that the amounts of slabs and edgings and cull blocks produced at Northeastern mills are quite close to the International $^1/_4$-in. log-rule allowances, when cull per cent is taken into consideration; but that the sawdust produced is somewhat in excess of these allowances because saws swaged to a little more than $^1/_4$-in. are commonly used, sawdust from edgers and slab cut-up saws is included, and the major product of most mills is $^4/_4$ lumber.

A test was made recently at four sawmills in Maryland, based on the cutting of 95,000 fbm of hardwood lumber. Circular head saws (Fig. 5) were used, cutting a $^9/_{32}$-in. kerf, and the bulk of the product was $^4/_4$ lumber. Slabs and edgings were sawed up into stove lengths. The green lumber produced was found to be 17 per cent over the nominal sizes, considering length, width, and thickness. The logs sawed averaged about 15 in. diam and 15 ft in length and had cull amounting to about 11 per cent of their volume. The products of sawing these logs are given in Table 4 with all values stated in solid green-wood equivalent.

The excess volume in the lumber would of course show up as waste in the form of shavings and trim at the planing mill, or in shrinkage in the drying process.

Table 4 Cubic-Foot Yield of Products per 1000 Fbm of Lumber Produced

Lumber	"Coarse waste" (slabs, edgings)	"Fine waste" (sawdust)	Total
97.1	29.4	34.9	161.4
(60.2%).....	(18.2%)	(21.6%)	(100%)

Conclusions and Recommendations

Many of the special sawing rigs designed specifically to saw small and low-grade logs are inherently wasteful, but still economical because of their productivity with this class of material. The gang circular-saw rigs used in the South are a case in point. Because of the heating difficulties experienced when a number of conventional saws are placed on one mandrel, it is necessary to use special rift saws in these gang circular mills. These cut about a $^3/_8$-in. kerf, and consequently make a lot of sawdust. Also, when saws are spaced at arbitrary intervals there is less flexibility in sawing procedure, and slabbing loss is unavoidably large.

This is true even with the sash-gang sawmills, Fig. 6, now widely recommended as economical log-conversion rigs. Slabbing waste with these machines is high, particularly when they are used with logs unassorted as to size. The sash gang does cut very accurately, and typically makes a narrow kerf. It is even possible to saw around a gradual curve with some models. Nevertheless, all sawing is done parallel to the heart of the log, and the first cut on the outside faces of the log cannot be placed accurately to minimize loss in slabs.

Standard American band and circular mills are highly flexible sawing tools, and if they are well maintained and operated it is difficult to improve on their ability to get maximum quality and quantity from the range of the log qualities handled. One machine that does give promise of being able to effect such an improvement, particularly when used with second-growth hardwoods, is the New England short-log bolter, Fig. 7, or "snapdragon."

With this sawing rig, short bolts are passed back and forth against the saw on a bench, instead of a carriage. A guide fence, beyond and parallel to the saw, guides the cutting. Consequently, because the material sawed is cut into short lengths, the effect of crook and sweep is minimized. Because relatively small saws are used, frequently of solid-tooth patterns, a kerf of $^3/_{16}$ in. or less is common. And because all sawing is done parallel to the bark, automatically, the maximum quantity and quality of straight-grain material is obtained.

Standard types of mills can be improved in construction, but more particularly in maintenance, to saw more accurately, with thinner saw kerf and less variability in sizes, and thus increase the proportion of lumber obtained even from poor-quality logs. There is, however, a definite limit to how far one can go in this direction particularly with small and low-grade logs, until the foresters are able to grow square and defect-free trees.

[4] "Factors Influencing the Manufacture of Sawlogs Into Lumber in Eastern Canada," by G. E. Bell, Canada Department Resources and Development, Forestry Branch Bulletin 99, 1951.

[5] "An Inventory of Sawmill Waste in Oregon," by Glenn Voorhies, Oregon State College Engineering Experiment Station Bulletin 17, 1942, 52 pp., illus.

Die Engineering

Specialization in Die Designing and Construction Has Shown a Need for and Also Stimulated the Use of Sound Engineering Fundamentals in Die Planning and Design

By Edward A. Reed

Assistant Chairman, Industrial Engineering Department, General Motors Institute, Flint, Mich. Mem. ASME

THE fundamental concept of die engineering for the manufacturer of pressed metal parts is that when metals are plastically worked, resisting forces are created as a result of the flow characteristics of the materials; therefore these forces or their components must be controlled by the use of dies and equipment to obtain parts of specified size, shape, and mechanical properties.

Analyzing the Die-Engineering Concept

A critical analysis of this statement of concept reveals the need for the application of the fundamentals of engineering. The first part of the statement refers to "plastically worked" metals which indicates the necessity for a knowledge of the metallurgy of commonly used ferrous and nonferrous metals.

The fundamentals of metallurgy are known and applicable to die engineering. Planning and design data for the characteristics of the product metal are available for such items as grain size, grain structure, grain growth, rate of strain-hardening, and the effects of hot and cold-working.

Further analysis of the second significant portion of the statement of concept which says "resisting forces are created as a result of the flow characteristics of the materials" involves the fundamentals of tensile and/or compressive stresses and resulting strains at various rates of working the metal in such basic die operations as cutting, forming, drawing, and extrusion. These forces can be shown on the workpiece layout for the purpose of analysis in planning and design.

The third portion of the concept is that "these forces or their components must be controlled by the use of dies and equipment." When the engineer designs or selects dies and equipment the control or elimination of factors such as wear, dirt, deflection, stock variation, and thermal effects in the workpiece are paramount in the control of the forces which are employed in the working of sheet metal to specified size and shape by pressed-metal processes.

The final portion of the statement of concept pertains to size, shape, and mechanical properties. These involve an obvious repetition of certain fundamentals indicated previously and a knowledge of the elastic behavior of product metal after removal of the working forces and counteracting forces applied through a die in order to hold the specified part size and shape. The determination of the degree to which the specifications of size, shape, and mechanical properties have been attained uses the die engineer's knowledge of measurement principles and implementation. In addition to size, shape, and structural requirements of a pressed-metal product a knowledge of surface-finish measurement is involved when the part is subjected to processes for protective or appearance coatings.

Table 1 Engineering Content Used in Die Engineering

Engineering Knowledge Required to Engineer Dies	Subjects Taught in Mechanical Engineering: Metallurgy	Materials	Strength of Materials	Mechanics (Statics and Dynamics)	Machine Design Elements	Heat Transfer	Hydraulics	Manufacturing Processes and Equipment	Stress Analysis	Product and Tool Analysis and Measurement	Quality Control
Grain Growth	x										
Grain Structure and Size	x	x									
Rate of Strain Hardening			x						x		
Tensile Stress			x						x		
Compressive Stress			x						x		
Strain	x		x						x		
Rate of Working of Metal	x		x						x		
Design of Dies and Equipment											
Wear	x	x			x						
Dirt					x						
Deflection			x	x	x				x	x	
Stock Variation	x	x						x		x	
Thermal Effects					x	x		x		x	
Surface Finish		x						x		x	x
Structural Properties		x	x							x	
Elastic Behavior-Springback		x						x	x	x	

Contributed by the Production Engineering Division and presented at the Annual Meeting, New York, N. Y., November 29-December 4, 1953, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The foregoing expansion of the statement of the fundamental concept of die engineering in terms of engineering-knowledge requirements in the metal-processing field is compared in Table 1 to engineering subjects taught in mechanical engineering.

Applying the Concept

The application of engineering fundamentals as related to the fundamental concept of die engineering can be emphasized further and shown by examples.

An example is the cutting of sheet metal into circular shapes in a "drop-through" type of cutting die.

In the example shown, Fig. 1, the cutting force F_c depends upon the metal thickness, length of cut, the shearing strength, and the clearance between the punch and die, as indicated by the expression $F_c = tlS_s$. Other practical theory must be considered, although it is not included in any published information.

Referring to the four points in the original statement of concept and Fig. 1, it is evident that the basis for the application of the fundamentals of engineering lies primarily in the forces caused by the flow characteristics of the material and the required control of these forces to produce a part to specifications.

The procedure indicates that the engineering knowledge gained in the subjects checked in Table 1 is immediately put to use: When determining the correct allowance for clearance between the punch and die the shearing characteristics of the material must be known. When the rate of shearing and the force required are determined, the punch and die can be designed as to sizes to produce a part to specifications and of proportions to resist the calculated foot-pound blow of the impact. Then, of course, the dieset is designed to maintain alignment between punch and die and to resist deflection within the specified tolerances of the part. Once the part has been cut, the stock from which it was cut must be stripped from the punch by a spring-actuated stripping plate which can be designed by starting again with the flow characteristics of the material and resisting forces. The stripping force is a percentage of the computed force to cut. These facts permit the calculation for the springs and the proportions for the stripper plate.

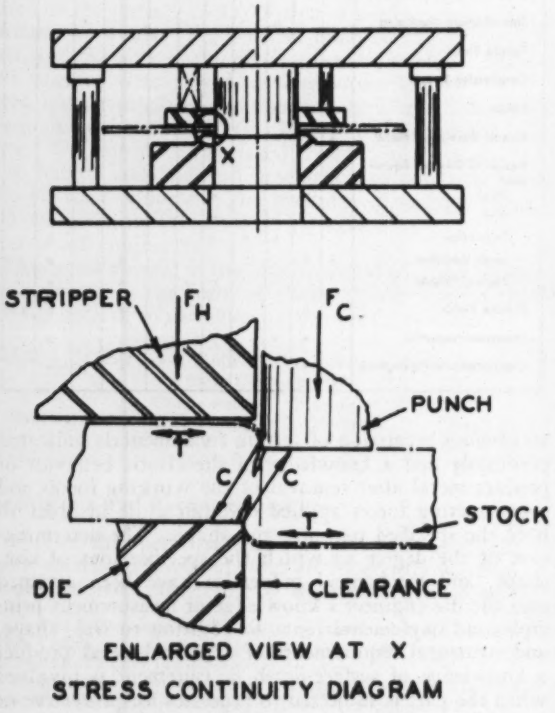


Fig. 1 Drop-through cutting die

A similar engineering approach is used in the planning and design or selection of the press for the actuation of the die just discussed. The specifications on a press such as capacity (tons), die space, ram velocity, and deflection characteristics actually are based upon the requirements of the material for a specific set of conditions in a die.

The same thought pattern as reviewed for cutting a simple part can be applied to the manufacture of parts requiring forming and drawing operations. It is essential for sound die engineering that the fundamental concept be adhered to for all planning, design, construction, and tryout of dies and equipment for the manufacture of pressed-metal parts and assemblies.

Experience indicates that pressed-metal parts can be classified broadly as to shape into the two categories of regular and irregular. The water pump and fan pulley on an automobile engine is an example of the former, and the front fender or almost any of the exterior appearance panels of an automobile are examples of the latter classification.

Planning Dies for Irregular Shapes

Most die engineers would agree that an engineering approach can and should be used in the planning of the water pump and fan pulley; however, it is certain that the same degree of agreement does not exist among die engineers responsible for the planning of dies for irregular panels.

In general, irregular-shaped panels are a composite of basic geometric shapes which can be treated as such in the preliminary planning analysis of the part. It is, however, in this type of planning that the die engineer must have some of the skills of craftsmen in visualizing and predicting what the resultant forces will be that have to be controlled by the die. There is an economic optimum in the use of the engineering approach to plan irregular part-processing, but it should not preclude the use of engineering fundamentals which ultimately will have the effect of decreasing design, construction, and tryout time along with a sounder over-all manufacturing process.

Up to this point an effort has been made to establish four significant and fundamental points:

1 That both craftsmanship and engineering must exist in the planning of tools and equipment for the manufacture of pressed-metal parts and assemblies.

2 That the fundamental concept of die engineering permits and requires the application of the engineering fundamentals learned in the college-level engineering curricula.

3 That all planning for the manufacture of pressed parts should be based on and guided by the fundamental concept of die engineering.

4 That the time required for the planning, design, construction, and try-out of dies can be decreased by the application of the fundamental concept of die engineering.

The fact that problems in die engineering require not only an engineer's knowledge but also a craftsman's knowledge presents a challenge in the educational development of die engineers. An option for die engineers, therefore, must be an option in mechanical engineering carefully planned to provide the proper balance between engineering fundamentals and applications, and a closely coupled work-experience schedule or other means of gaining practical experience.

A Course in Die Engineering

A die-engineering option such as the one developed at General Motors Institute is offered in the third and fourth years following two years of basic engineering. This die-engineering option follows the common approach of being composed of application courses; but it also features the important approach of including advanced interpretations of fundamentals required for the thorough understanding of the fundamental concept of die engineering.

In the development of the subjects for the option it was found convenient and it later proved effective to appraise the subject content according to the teaching methods which were determined to be demonstration, verification, and investigation.

The demonstration method is used for the Junior Engineering Design on Dies. Operations such as cutting, forming, and drawing in the basic type of dies are demonstrated to show die-press relations, the loading and unloading of the die, the mechanical motions in the die and press, and the resulting product. The dies are disassembled to emphasize the size and shape of die components and their conditions of fit. The proportions of the components, whether designed or standard commercial, are pointed out. Good and poor design proportioning is further demonstrated by the use of strain gages and plastic models in a polariscope.

The demonstration method complements the co-operative engineering student's background, obtained both at the Institute and in his planned work experience at the plant, and begins to build his knowledge of design principles and rules and of the elements of designs which actually control the forces caused by the flow characteristics of the material of the pressed-metal product.

During the latter part of the junior year, work is started on verification of the principles taught early in the first semester. Proved setups are made in the Die Engineering Laboratory so that students verify the expressions for cutting, forming, and drawing forces in order to make calculations for proper press specification. Material performance in the dies is correlated with test data from the metallurgical laboratory and whenever possible from the vendor.

In the senior year investigation problems are presented to the students to further the opportunity for the application of fundamentals, but more important, to provide them an opportunity to analyze and solve pressed-metal-plant problems using the engineering approach. Generally, these problems are of a nature that require more than the direct application of engineering fundamentals. They must learn to combine principles applicable to regular shapes in the solution of irregular complex parts. This type of work co-ordinated with plant-work experience prepares them for pressed-metal processing during the latter part of the senior year.

The course of instruction the students have received in the die-engineering option of mechanical engineering has provided an opportunity for them to learn the fundamentals of engineering through the application of the fundamental concept of die engineering for all classifications of pressed-metal work.

Applying Die-Engineering Theory

The work which die engineers claim, and which a recent survey of plant needs in the field of die engineering shows should be encouraged, falls into two broad classifications, i.e., applied theory and practical use of theory. Suggested projects, related to the former classification, are further divided into specific types of metal flow such as occur in cutting, forming, and drawing and briefly stated as follows:

Cutting. A scientific determination of cutting die clearances for commonly used metals with data on the edges of the hole and the piece of metal cut out.

Dynamic stripping forces should be determined and the stress-strain relations for cutting should be studied.

A thorough investigation should be made concerning hole and blank tolerances.

Forming. There are several problems concerning regular and irregular shapes which should be studied. The problem of holding forces for forming die pads and forming forces that control the metal flow into highly strained areas should be studied since it affects all phases of die engineering.

A more accurate method of predicting springback would greatly refine the work of the die planner and designer, and many die engineers point to the need for more information on blank development which ultimately would decrease die-tryout time.

Drawing. The most pertinent problem in drawing of metal is the lack of an index of drawability and the necessary measurement equipment for laboratory and production-floor use.

Another important problem concerns the distribution of draw operations in relation to the strain-hardening properties of the metal. This would lead to a further study of the possible application of strain data to irregular drawing and forming which would benefit the die engineer immeasurably.

It is encouraging to observe and read of the work which is currently being done of the type suggested for further study. Some societies also are interested in promoting and financing sound projects which would be of value to college instruction and of a practical value to industry.

In the practical classification, the work which should be encouraged concerns skilled personnel within the pressed-metal-production areas of the larger corporations and small manufacturing plants.

There is an urgent need for an organized means of collecting the "know-how" of the pressed-metal specialists and die engineers, particularly those who have had many years of rich experience in the field. Some of this group have the ability to pass on their knowledge by writing, others by on-the-job instruction. The "why" back of the valuable know-how possessed by those who have learned by doing must, however, be obtained for use in the field.

By adherence to the fundamental concept stated in this paper and the suggested integrated effort of college and industry the growth and effectiveness of die engineering is unlimited.

A Report on Progress in Railway Mechanical Engineering—1952-1953[1]

Electric Locomotives

THE extent to which high horsepower can be concentrated in relatively low weight in electric locomotives is well illustrated by the German Federal Railways locomotive shown in Fig. 25 and described under item 1 of Table 3. At the 1-hr rating of the locomotive the horsepower/ton ratio is 50 and at the continuous rating works out to 48. The total weight of 91.5 tons and the high rating speeds, obviously, are dominant in the realization of such high power-weight ratios.

The 3000-volt electric locomotive shown in Fig. 26 and described under item 2 of Table 3 is a standardized design adopted by the Spanish National Railways for its long-range electrification program. Twenty units have been delivered by the builders and sixty additional to the same design are under construction in Spanish manufacturing facilities. Unlike American practice, the traction motors are truck-mounted, fully sprung with quill and flexible drive to each of the six axles.

Fig. 27 shows a locomotive twelve of which have been furnished by ACEC (Belgium) for the new 50-cycle electrification installed in the Belgian Congo on a 65-mile, 1.25 per cent grade, single-track line of the Bas Congo-Katanga Railway. The locomotive is built for 42-in. gage, and each axle of the B-B arrangement is fitted with a twin-armature, single-phase, series-wound, quill-mounted, flexible-drive traction motor with a 1-hr rating of 404 hp for the two armatures. An unusual feature (seldom found in electric-locomotive control systems) is the provision of semiautomatic notching for acceleration. Notching is under the control of a relay arranged to provide three rates of acceleration, the rate being selected by manipulation of a special handle on the operator's controller. Dynamic (rheostatic) braking control is provided, with the traction motors separately excited from a d-c generator driven

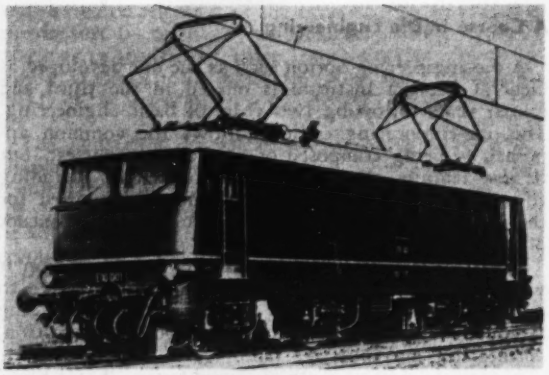


Fig. 25 German Federal high-powered standard electric locomotive

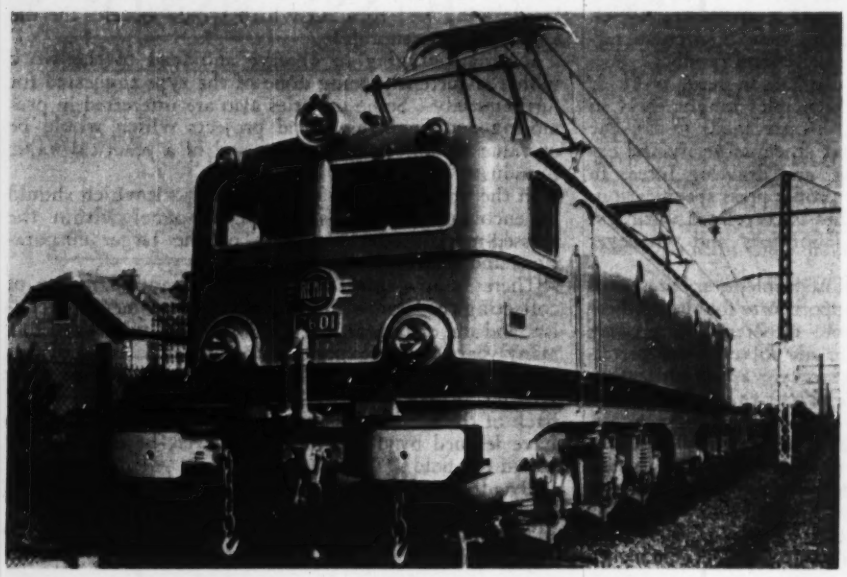


Fig. 26 French-built 3000-volt electric for Spain

[1] The first section of this report was published in the March, 1954, issue of MECHANICAL ENGINEERING, pages 236–247.

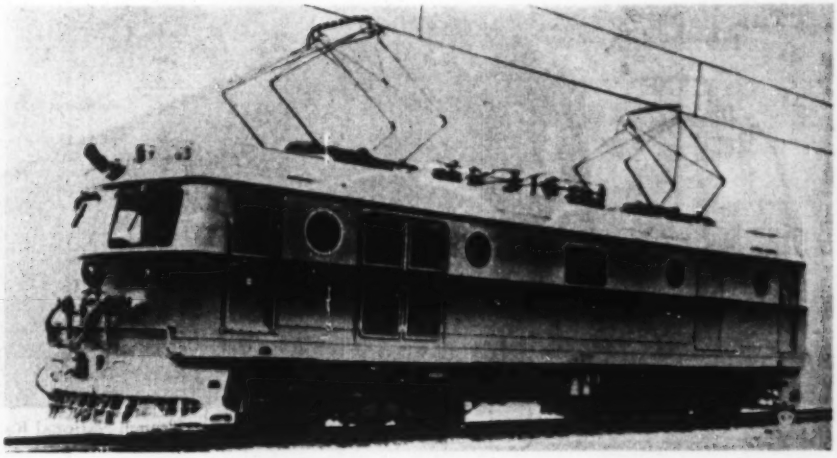


Fig. 27 50-cycle electric locomotive for Congo

from a single-phase split-phase-starting induction motor. Characteristic data applying to the locomotive are given in item 3 of Table 3.

Gas-Turbine Locomotives

The Union Pacific accepted delivery on its initial order of ten 4500-hp gas-turbine units built by General Electric and all ten are in pooled revenue service burning residual oil with commendable success (3).[2] This railroad has placed an order for 15 additional units to the same basic design as the first ten. Delivery is expected on these 15 units during the coming year.

One of the initially ordered units was modified by the railroad to utilize propane gas as fuel. A tank-car tender especially fitted for the purposes of the tests was furnished and a gas regulator provided to handle the piped gas from the tender. As this report is being written, the economic aspect of propane as a turbine fuel is still under evaluation.

Interest in the free-piston gasifier-turbine combination as a locomotive prime mover appears to have been revived in the United States, following the construction and operation of an experimental 1000-hp locomotive in France, and work by several domestic engine builders on this type of prime mover for marine and stationary applications. As of this writing and to the committee's knowledge, there are no locomotives employing the free-piston gasifier under construction in the United States, but work on laboratory models of such prime-power plants is progressing in several localities.

Last year's report (4) of this committee mentioned briefly that the 1000-hp free-piston gas generator-turbine locomotive was in experimental operation on the lines of the French National Railways. Additional data on this locomotive have become available since the latest

[2] Numbers in parentheses refer to the Bibliography at the end of the paper.

Table 3 Electric Locomotives

Item No.	1	2	3
Railroad	German	Spanish	Congo
Builder, mechanical	K-M	Alsthom	AMN
Builder, electrical	AEG	Alsthom	ACEC
Wheel arrangement	B-B	C-C	B-B
Service	F&P	F&P	F&P
Power supply	15000 v-16 2/3 C	3000 v, d-c	22000 v, 50 C
Current collector	Panto.	Panto.	Panto.
Driving wheels:			
Number	8	12	8
Diameter, in	53	49 1/4	63
Weights, lb:			
Total	183000	265000	160500
On drivers	183000	265000	160500
Per axle	45750	44200	160500
Dimensions, ft-in.:			
Length over-all	52-10	62-1 3/8	49-5
Width over-all	10-0	10-9	9-11 5/8
Height, panto. down	13-10	13-11 3/4	13-8
Rigid wheel base	10-6	14-9	8-2 3/8
Total wheel base	36-8 1/2	45-3	31-9 7/8
Traction motors:			
Number	4	6	4 Twin
Method of mounting	Frame	Frame	Frame
Method of drive	Quill	Quill	Quill
Gear ratio	1/2.486	1/3.15	1/6.93
Tractive force, lb:			
One-hour rating	28600	40200	20350
Per cent adhesion	15.62	15.2	12.7
Continuous rating	27000	26500	—
per cent adhesion	14.75	13.8	—
Horsepower:			
One-hour rating	4580	3170	1615
Continuous rating	4400	2970	—
Speed, mph:			
One-hour rating	60.0	29.5	29.7
Continuous rating	61.5	30.5	—
Maximum speed, mph	81.0	68.6	43.75
Electric baking	—	Regen.	Rheostatic
Multiple-unit operation	Yes	No	Yes
Track gage, in.	56 1/2	66	42
Fig. No.	25	26	27

LEGEND:
German — German Federal Rys.
Spanish — Spanish National Rys.
Congo — Bas Congo-Katanga Ry.—Belgian Congo.
AMN — Ateliers Metallurgiques de Nivelles—Belgium.
ACEC — Ateliers de Constructions Electriques de Charleroi—Belgium.
K-M — Krauss-Maffei A.G.—Germany.
Alsthom — Societe Alsthom—France.
AEG — Allgemeine Elektricitats Gesselschaft—Germany.

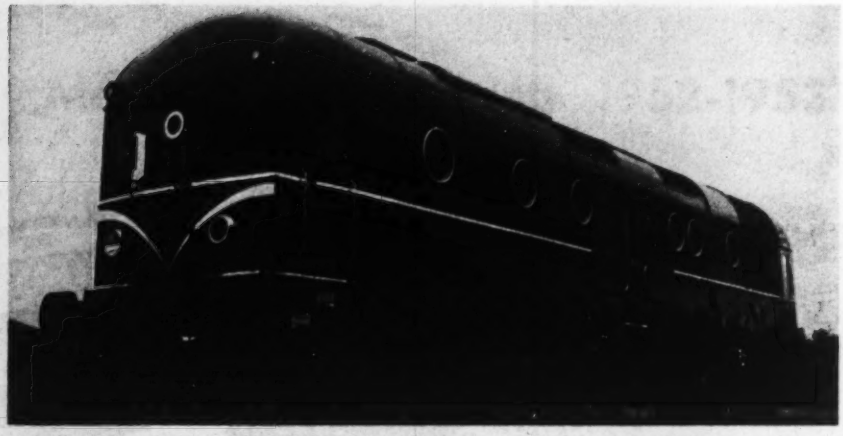


Fig. 28 Free-piston locomotive operating on French National Railways

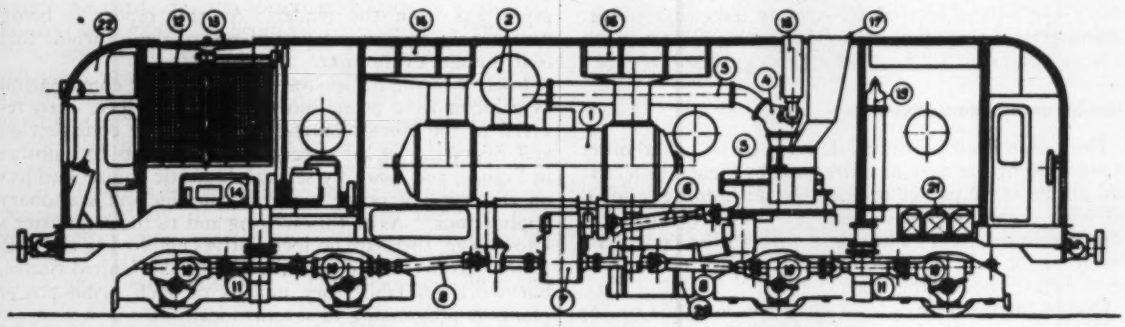


Fig. 29 Equipment layout of free-piston turbine locomotive

1 Gas generator
2 Buffer tank
3 Gas feed pipe
4 By-pass
5 Gas turbine
6 Transmission shaft turbine to reduction gear
7 Reduction gear and two speeds
8 Drive to axles
9 Bogie
10 Axle housing
11 Drive shaft between two axles
12 Radiators for oil and water
13 Fan
14 Auxiliary diesel engine
15 Auxiliaries: Compressors, water and oil pumps, electric generator, electric motor
16 Air filter under roof
17 Turbine exhaust
18 By-pass exhaust
19 Compressed-air bottles for starting generator
20 Turbine oil tank
21 Storage batteries
22 Driving cab

RR-6 report was presented, and this, in conjunction with the upsurge of interest in the free-piston gas generator-turbine as a prime mover, seems to justify a more detailed description of the French locomotive at this time and for the record.

Fig. 28 illustrates the external appearance and Fig. 29 gives a diagrammatic layout of equipment in the French locomotive. Fig. 30 is a cross-sectional view of the Pescara free-piston gas-generator, or gasifier, as it is sometimes called. Salient data on the locomotive are given in Table 4.

Detailed descriptions of the Pescara gas generator, and of two other designs of this type of prime mover on which development is going forward in the United States are given in papers (5, 6, 7) presented at the ASME Spring Meeting, Columbus, Ohio, April 29, 1953.

The *Railway Gazette* of Feb. 20, 1953, page 205, reports the construction of an experimental gas-generator locomotive in Kharkov (USSR) using three units, each unit with two 2-axle trucks. Fuel consists of anthracite coal with a small amount of liquid fuel. Further details are, understandably, lacking at this time.

Steam-Turbine Locomotives

Another attempt to put the steam turbine to work in American railroad motive power came to fruition with the completion of the 4500-hp unit built by Baldwin for the Norfolk and Western Railway. Outstanding in this design is the use of a boiler pressure of 600 psig with a noncondensing cycle. An appreciable betterment in thermal efficiency and steam rate over those secured with recent designs of steam-turbine units is expected, attributable largely to the elevated working pressure employed.

The locomotive consists of an engine and tender; the engine measuring 111 ft $7^1/_2$ in. between coupler pulling faces and the tender measuring 49 ft, 6 in. between coupler pulling faces. The over-all length of the loco-

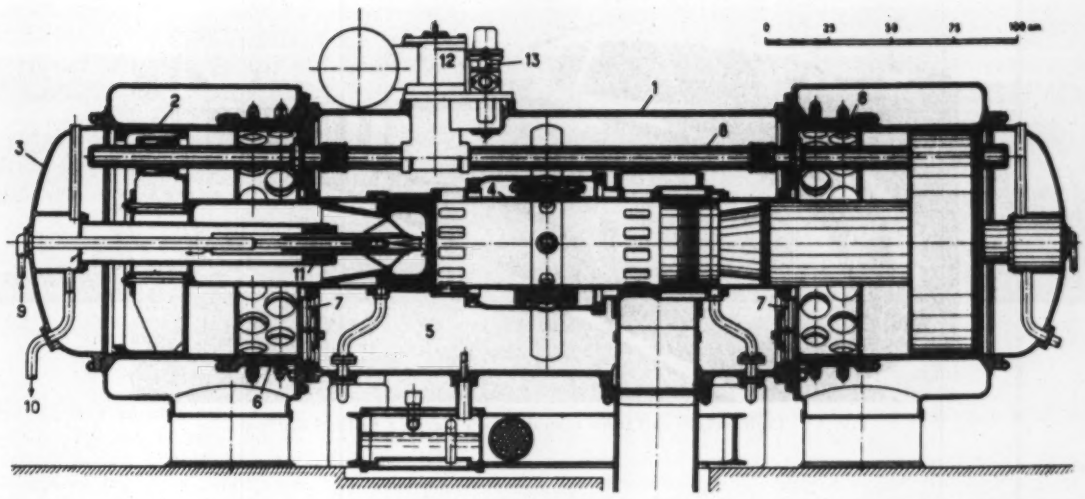


Fig. 30 Pescara free-piston gas-generator

1 Main shell
2 Compressor
3 Compressor cylinder head
4 Power cylinder
5 Compressed-air space
6 Air-inlet valves
7 Air-outlet valves
8 Balancing pipe
9 Piston cooling-oil inlet
10 Piston cooling-oil outlet
11 Gland
12 Starting valve
13 Stabilizer

motive is approximately 161 ft. Other dimensional characteristics are given in Table 5.

The engine is carried on four 3-axle trucks, all axles being motor-driven. A span bolster connects the two front trucks and another connects the two rear trucks. The engine underframe rests on two center pins, one on each span bolster. Power for traction is furnished by two generators having a common rotor. One generator supplies power to the two front trucks, the other supplies power to the two rear trucks.

The engine is divided into six sections or compartments. The operator's cab is located forward of the center of the locomotive and contains all the controls required for operating the locomotive. A coal bunker occupies the section forward of the operator's cab. The front compartment, forward of the coal bunker, contains the dynamic braking equipment for the two front trucks. Behind the operator's cab are the steam-generator compartment, the power-plant compartment, and the dynamic-braking compartment for the two rear trucks.

The tender is carried on two 3-axle trucks. It has a capacity of 22,000 gal and, in addition, carries a water-treatment installation to provide treated water for the steam generator.

The boiler is of the water-tube type with natural circulation and delivers steam at 600 psi and 900 F. The boiler is stoker-fired by a stoker similar to the conventional steam-locomotive stoker and has steam jets to distribute the coal over a traveling grate. Forced draft,

Table 4 Gas-Turbine Locomotive

Builder	Renault
Wheel arrangement	B-B
Service	Passenger
Weight on drivers, lb	118000
Total weight, lb	118000
Length over-all, ft-in	53-0
Fuel	Oil
Fuel capacity, gal	—
Driving-wheel diam, in	35.4
Type of drive	Mechanical
Gage, in.	56½
Maximum speed, mph	77
Turbine data:	
Number	1
Horsepower	1175
Speed, rpm	8500
Manufacturer	Kateau
Gas-generator data:	
Number of units	1
Manufacturer	Sigma
Cylinders, No.	1 (OP)
Cylinder dimensions, bore and stroke, in.:	
Power	13.4 × 17.73
Compressor	35.5 × 17.73
Bounce	35.5 × 17.73
Cycles per minute	600

Table 5 Steam-Turbine Locomotive

Builder	BLH in collaboration with Babcock & Wilcox, Westinghouse Electric Corp., and the Norfolk & Western Rwy.
Owner	Norfolk & Western Rwy.
Wheel arrangement	0-6-6-6-6-0 (C-C-C-C)
Service	Heavy freight
Quantity built	One
Hp rating	4500 hp for traction
Steam generator	Babcock and Wilcox
Steam turbine	Westinghouse
Electrical equipment	Westinghouse
Weight of engine	807000 lb
Weight on drivers	807000 lb
Weight of tender	365000 lb
Total locomotive weight	1172000 lb
Fuel capacity	20 tons
Type fuel	Bituminous coal
Water capacity	22000 gal
Driving-wheel diameter	42 in.
Type of drive	Electrical
Gage	4 ft, 8½ in.
Maximum speed	50 mph

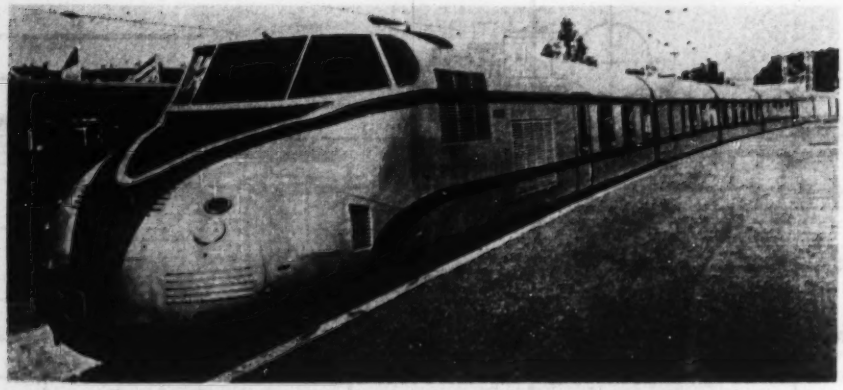


Fig. 31 Lightweight rail train operating on German Federal Railways

an economizer, and an air heater are provided. Operation is automatic through a system of pneumatic controls. Steam from the boiler drives a noncondensing impulse-type turbine which is connected through a set of single-reduction gearing to the two-unit d-c traction generator.

Steam Locomotives

The conventional steam-piston locomotive continues to operate on many domestic railroads but is being displaced by the diesel at a rate of some 4000 to 5000 units per year. Only one American railroad continues to acquire new steam locomotives and these are to its own designs built in its own shops.

One American locomotive builder and one Canadian continue as heavy steam-locomotive manufacturers for overseas markets, while English and German builders still furnish this type of locomotive for their own domestic markets and for overseas shipment, chiefly for use in those countries with indigenous coal supply but little or no national oil resources.

None of the sources from which data were requested by the committee has submitted descriptions of steam locomotives with notable features built during the past year, and the committee concludes from this that those locomotives that were built during the period have been to more or less conventional designs with no particularly reportable outstanding characteristics.

Rail Cars and Trains

Aside from a few relatively early instances, the rail train has never taken hold to any appreciable extent on American railroads, and many of the earlier diesel-propelled trains long since have been replaced by the more conventional locomotive-hauled consists of standard passenger cars. On the contrary, the use of rail trains in Europe has been developed to a high degree, and the postwar years have witnessed the construction of many notable designs, outstanding in particular in the weight per passenger seat and in horsepower per unit of weight.

Space limitations preclude any extensive treatment in this report of the many designs in current operation and the reader is referred to reference (8) for excellent descriptive sources of this type of rolling stock. Two trains—one diesel-propelled and the other electrically propelled—seem to warrant brief mention in this report.

The German Federal Railways has placed in service two lightweight diesel trains that are outstanding because of the low over-all weight. One train is a day train with dining service, while the second train is composed of sleeping cars. The day train consisting of seven units (one combination power-and-seat car and six seat cars) has an over-all length of 318 ft with a seating capacity of 135. Lightweight of the train is reported to be 106 tons, or 1600 lb per seated passenger. Propulsion power is furnished by four 160-hp engines totaling 640, with which a top speed on level track of 75 mph is attainable. With a seated passenger load and crew of 22,000 lb the power-weight ratio of the train works out to 5.82 hp per ton. Transmission is through mechanical drives with hydraulic elements. Fig. 31 shows the day train at a station platform.

The Italians have built and have in daily operation high-speed multiple-unit electric trains which incorporate a novel feature in that the usual operator's position has given way to a front-end observation section for passenger occupancy. The operator's position at each end of the train projects above the car roof contour as shown in the view of the seven-car train in Fig.

Fig. 32 High-speed electric streamliner in service on Italian State Railways

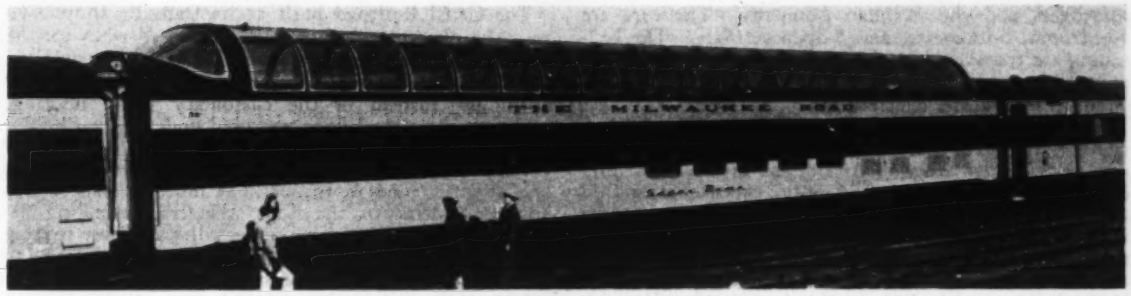


Fig. 33 Full-length dome car for the Milwaukee

32. With a total motor horsepower (1-hr rating) of 3040 for the entire train, normal top speed is 98 mph. Higher speeds in the neighborhood of 149 mph have been attained in test runs. The two outer coaches at each end of the train are articulated, while the three center coaches form a triple-articulated assembly. Thus the seven-car train is carried on a total of 20 axles, with but a total of 12 motored axles. The trains operate under the standardized 3000-volt d-c electric system characteristic of most of the Italian electrified railroads.

Passenger-Train Cars

Probably the outstanding departure from conventional design during the year just past is the full-length dome-lounge car, the first of which was furnished in late 1952

Table 6 Principal Dimensions and Weights of Milwaukee Dome Cars

Length over platform, coupled, ft	85
Length between truck centers, ft	59
Width over side sills, ft	10
Width, inside between posts, ft-in	9-6
Height, rail to top of roof (dome), ft-in	15-6
Height, rail to top of roof (conventional), ft-in	13-6
Height, rail to top of floor, ft-in	4-3
Height, rail to top of low floor, in	23
Height, rail to top of dome floor, ft-in	8-8
Truck, wheel base, ft	11
Wheel, diameter, in	$36^1/_2$
Journal size, in	$6^1/_2 \times 12$
Scale weights, lb:	
Car body	134050
Trucks (two)	66550
Lading	9080
Passengers	14400
Ready to run	224080
Lading weight details, lb:	
Fuel oil	2250
A-C condenser water	1586
Air-pressure water	2829
Lockers and refrigerators	2065
Crew	350
Total	9080
Passengers' weight details, lb:	
68 seats in dome	10200
28 seats in lounge	4200
Total	14400

to the Milwaukee Railroad by Pullman-Standard. The principal dimensional characteristics are as given in Table 6; and the car is shown in Fig. 33.

The upper level under the dome is designed to accommodate 68 seated revenue passengers while the centrally located lounge on the lower level affords non-revenue seating for 28 passengers.

Part of the lower level space over the trucks is utilized for air-conditioning equipment, car power-supply equipment, and fuel and water tanks. A small kitchen-bar section is located centrally and adjacent to the lounge space.

A 50-kw diesel-electric power plant and a 20-ton air-conditioning equipment are furnished to service the car.

The six-wheel trucks are of a special General Steel Castings Company design, utilizing coil springs exclusively, rubber bumpers, Fabreeka insulating pads under the equalizer ends, and rubber pads to damp vibration and noise in the constant-contact friction side bearings. Lateral movement of the bolsters carrying the car body is transmitted through the bolster springs.

Pullman-Standard completed 29 new sleeping cars—22 for the L&N, 4 for the C&EI, and 3 for the NC&StL. These cars represent an attempt between three railroads to purchase equipment patterned along a standard line and incorporate important ideas gathered from a study of over 2000 suggestions received from sleeping-car

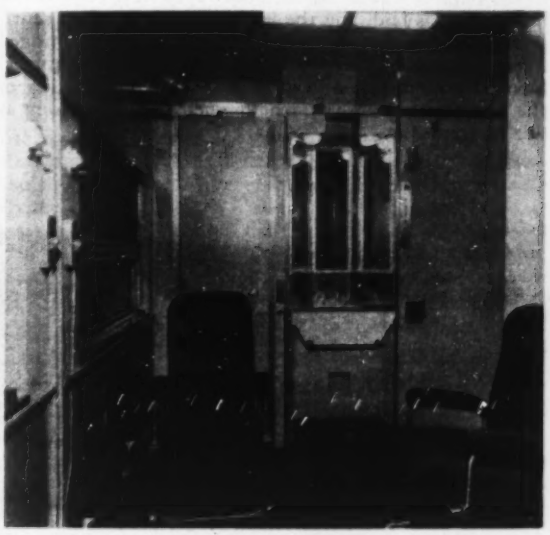


Fig. 34 Double-bedroom compartment of new Pullman-built sleeping cars

passengers and the Pullman Company. The cars are 4-bedroom, 6-roomette, and 6-open sections. The bedrooms are transverse of the car, can be opened up into pairs and are pictured in Fig. 34. The cars are of high-strength steel-girder construction.

A notable order for passenger-train cars for the National Railways of Mexico has been executed by the Swiss firm of Schindler Waggon A.G. The group, consisting of 57 cars, is made up of 25 ordinary coaches and 32 units of "luxury" class involving six different layouts of which two are sleepers. The cars are to be used in the railway's "Aztec Eagle" service between Mexico City and the U. S. A. border, but may, on occasion, operate on U. S. A. lines with American rolling stock. For this reason principally, the cars were constructed to AAR standards as to strength and, in particular, as to buffing load requirements. Lightweight, all-welded stressed-skin construction is employed in the car bodies. The two-axle trucks are built to Swiss designs without axle-box guides of the usual form and are equipped with SKF roller bearings. Over-all length of the cars is 82 ft, 2 in., and the ordinary coach weighs approximately 48 tons.

Freight-Train Cars

In the past year, in addition to the production of standard types of freight cars, there were continued efforts in two major directions for further development of freight equipment: (*a*) A larger number of special cars were built for handling specific types of lading or commodities; (*b*) there were continuing efforts to develop means of reducing damage to lading in transit.

The Northern Pacific, in an endeavor to solve the problem of handling perishable lcl freight—particularly meat—economically and safely in mixed-service merchandise cars, converted 15 old refrigerator cars into combination refrigerator-merchandise cars. In this conversion one end of the car was closed off, using regular refrigerator-car doors, thereby retaining that end of the car as a fully insulated, refrigerated compartment. In the balance of the car the floor racks were removed, a new floor was laid, and the ice bunkers and ceiling ventilators were removed. The regular, insulated, hinged refrigerator side doors were removed and conventional boxcar doors installed in their place. A single icing of the refrigerated compartment frequently lasts as long as five or six days.

The C&EI Railroad built at its Danville shops two special tank cars to handle bulk condensed whey for the Consolidated Products Company. The cars themselves are basic AAR 40-ft 50-ton boxcars with 6-ft side-door openings. Instead of the customary wood flooring, a $^{3}/_{16}$-in. plain steel floor was used under the tanks and step plates were used between the doors and in front of the tanks. Two 6000-gal whey tanks were installed, one at either end of the car. A deafening sheet was applied underneath the floor stringers, extending between the side sills and the center sill. A heavy coating of Insulmat was applied to the top side of the deafening sheets. No insulation was used on the sides, ends, or roof, as the two whey tanks were insulated with cork and Fiberglas. The lightweight of the car is 67,800 lb.

Early this year General American Transportation Corporation exhibited a new-type covered hopper car called the "Airslide" car, designed for bulk shipment of a wide range of dry powdered materials such as flour, feedstuffs, chemicals, starches, and the like. The car can be built in sizes of 2000, 2600, and 3600 cu ft. The main feature of the new car, which is essentially a standard covered hopper car otherwise, is the use of the Fuller Airslide. The essential part of the Airslide is a fabric of special design stretched over a U-shaped shallow steel channel. The channel below the fabric forms a plenum chamber into which air is introduced at a pressure of approximately 1 psi. As air is forced through the fabric the lading is aerated and fluidized, causing it to flow like water to the unloading point. The Airslide forms the bottoms of parallel hoppers between longitudinal slope sheets in each end of the car and also slopes toward the center of each half of the car.

The Pennsylvania Railroad built a bulk-sugar car from an existing boxcar for the American Sugar Refining Company. Three hoppers built of plywood with stainless-steel lining have a total capacity of 2060 cu ft. The tops of the hoppers are insulated, but the air space inside the car forms the only side insulation. There are ten hatches in the car roof extending down to the hoppers, but only one outlet for each hopper. Side doors on the car were sealed and end access doors added.

The Baltimore and Ohio Railroad also built a bulk-sugar car from an existing boxcar for the American Sugar Refining Company. This car has three compartments with a total capacity of 100,000 lb in 2060 cu ft.

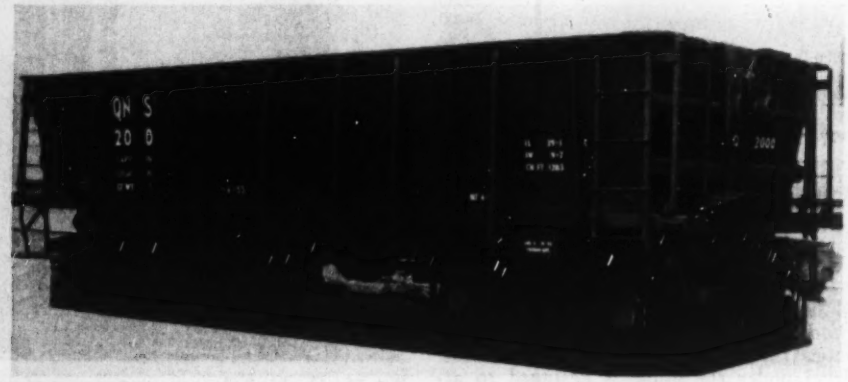


Fig. 35 New design of ore car with roller bearings for service in Labrador

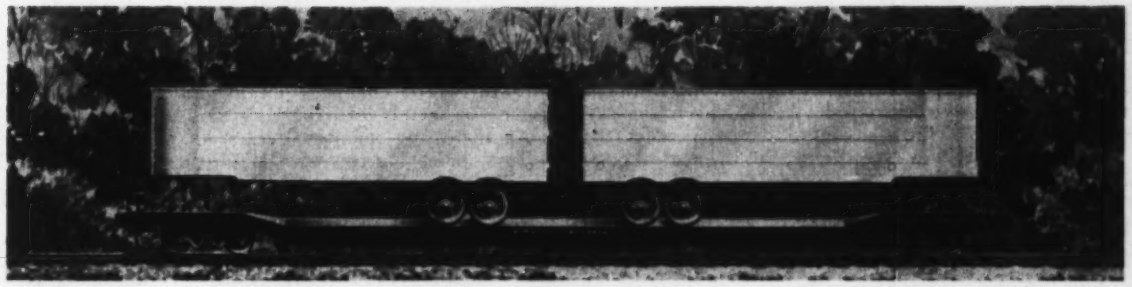


Fig. 36 Artist's conception of EMD freight car for road trailer haulage

Fig. 37 Freight-car truck with air-cushion springing

Fig. 38 Bolster, cushion assembly of truck shown in Fig. 37

Eight roof hatches in the roof allow for uniform loading, and three hoppers each straddling the center sill then merge into three common center outlets. The portion above the floor of each compartment is built of $^3/_8$-in. masonite, that below the floor of OHS with stainless-steel lining, and the hopper gates are of aluminum.

Pullman-Standard exhibited a new-design welded covered hopper car, which will be built in three capacities—2003, 2893, and 3188 cu ft. The car is designed for minimum maintenance over its life, is of heavy construction and simple clean design. Circular hatches, simple and safe to operate, and improved construction details give a roof that is nearly self-cleaning or clearing.

The demand continued for flatcars, expecially those of high capacity for special loads and to handle large shop-assembled rather than field-assembled units. This type of car is evidenced by the following examples.

The Canadian Pacific built six 70-ft depressed-center flatcars, the first in Canada, having a capacity of 339,200 lb. Two pairs of 4-wheel trucks are used at each end of the cars.

Magor Car Corporation delivered to the Army Transportation Corps the first of an order of 100-ton high-tensile steel flatcars. These cars are 54-ft, 8 in. long over striking castings, have a lightweight of 69,400 lb, and a capacity of 245,600 lb.

Pullman-Standard built for the Quebec, North Shore, and Labrador Railroad 1200 ore cars, one of which is shown in Fig. 35. This railroad as well as the ore operation, being completely new, enabled the purchasers to specify the design of an ore car which they felt most suitable for their use. The cars have a level capacity of 1283 cu ft, are 34 ft long over pulling face of the couplers, are equipped with $6^1/_2 \times 12$-in. roller bearings, empty and load brakes and clasp brakes. The lightweight is 54,700 lb and the capacity 95 tons. The bodies of these cars have been made especially heavy; i.e., $^5/_{16}$-in. side and end sheets and $^7/_{16}$-in. floor sheets, on the premise that these bodies will not require any rebuilding during the life of the car, and maintenance should therefore be limited to running gear.

The largest tank car built to date has been furnished to the Canadian Pacific by the American Car & Foundry Company. The car, which is the first of an order for 65, has an over-all length of 51 ft, weighs 65,200 lb light, and has a capacity of 16,000 Imperial gal or 19,200 gal (U. S. A.), with a loading capacity of 144,000 lb. The cars will be used primarily for the transport of diesel fuel for Canadian Pacific motive-power use.

To make a thorough study of the best methods of packaging, blocking, and stowing, as well as to study the shifting of lading and damage in switching impacts, the Bureau of Supplies and Accounts of the Navy had a special test car built by Pullman-Standard Car Manufacturing Company. This car is a standard 40-ft, 50-ton PS-1 boxcar with the ends strengthened and the underframe at the ends reinforced to resist distortion and possible car failures through repeated high-speed impact tests. One side of the car is a truss construction with large removable outside and inside panels extending between posts to permit opening up to full view the load from one side of the car. This will simplify the study of loading patterns and also will permit a visual study and a motion-picture recording of the shifting of lading and damage to lading during impact. The car is equipped with a Pullman-Standard compartmentizer at one end, Evans loading racks at the other end, and also with lading strap anchors.

The Western Pacific has operated since last fall two test Pullman-Standard boxcars utilizing a cushion

underframe. In this cushion underframe a conventional draft gear, coupler, and yoke are used at each end of the center sill. The center sill slides in the car underframe and its connection or attachment to the car underframe is through a rubber cushioning device located at the center of the car. This cushioning device permits the center sill to move 8 in. to either side of the neutral position with respect to the car body.

During the past year there were continued studies by railroads, shippers, and industry to develop means of minimizing lading damage, particularly in boxcars. These means include cushioning devices as previously mentioned, various devices for blocking and anchoring lading in position, and also special designs of blocking and anchoring for use in handling a specific commodity.

The AAR recently approved acceptance of 100,000 Griffin Wheel Company's "EQS" (electrical-quality steel) wheels for use in interchange. These wheels, designated by the AAR as X-3 steel freight-car wheels, are pressure-poured in a graphite mold. A 7-ton ladle has a capacity of pouring 18 wheels.

Fig. 36 shows a car designed and built by the Electro-Motive Division of General Motors Corporation to carry two standard highway semitrailers up to as long as 35 ft, back to back, side-loaded onto the cars on a depressed track or from an elevated platform. Of all-welded construction, the car is 75 ft long, 9 ft, 6 in. wide, and has a lightweight of 67,000 lb. The depressed center section allows for 15 ft of overhead clearance and is carried 29 in. above rail height. Running the length of the depressed section is a raised portion that improves car strength and prevents side movement of a trailer should it break loose from its tie-down devices. Stanchions are provided at either end of the car to engage the trailer king-pins. These stanchions are equipped with rubber shock absorbers to permit $4^1/_2$ in. of movement of the trailer in both directions longitudinally, thus absorbing any shock due to slack action in the train. Capacity of the car is 120,000 lb.

A joint development of General Tire and Rubber and Timken is a pneumatic cushion, Figs. 37 and 38, intended for application to and the replacement of steel springs in freight and passenger-car trucks. The cushion secures its air supply from the car's brake-pipe line. Air is fed into the cushion through an automatic pressure regulator which maintains a constant car-body height, regardless of the magnitude of the car loading. The regulator incorporates three air-control stages—air admission, air emission, and a neutral position. In the event of failure of the air cushion, rubber shock pads within the cushion assembly take the load-carrying duty.

The "Hotbox" Problem

The committee feels that this progress report would be incomplete without, at least, passing mention of the accelerated attention being accorded the freight-car "hotbox" problem. A number of patented wasteless lubrication systems and waste-retaining devices, all applicable to the standard AAR freight-car journal without change in the journal and box geometry, have appeared on the market during the past several years. Many of these are in revenue service with varying degrees of success having been attained. At least one manufacturer has brought into experimental service a cartridge-type of solid bearing completely sealed against entrance of foreign matter and utilizing no waste for the lubrication and oil-retaining duty. The bearing, however, involves a change in journal geometry and truck-frame disassembly for its application.

An increasing number of cars are being built with roller bearings but these cars are intended for on-line use or limited interchange service, where maintenance parts and facilities are readily available.

Several programs aimed at a reduction in journal-bearing failures are covered in papers which have appeared in the technical press (9, 10, 11) during the past year and emphasize that the "hotbox" problem can be ameliorated materially by proper and improved maintenance, inspection, and supervision, and the utilization of suitable oils and waste.

Further interest in the subject is manifest in the technical papers presented at the Society's 1953 Annual Meeting under the auspices of the Railroad Division.

Acknowledgments

The Committee gratefully acknowledges assistance in procuring material for the report given by the railway press of the United States; by the *Railway Gazette* and *Diesel Railway Traction* of England; by the railways, locomotive, car, and equipment builders of the United States, England, France, Germany, Japan, and Switzerland.

Bibliography

1 "Progress in Railway Mechanical Engineering," MECHANICAL ENGINEERING, vol. 69, 1947, p. 208.

2 "Progress in Railway Mechanical Engineering," MECHANICAL ENGINEERING, vol. 75, April, 1953, p. 294.

3 Ibid., p. 301.

4 Ibid., pp. 301–302.

5 "The Development of High-Output Free-Piston Gas Generators," by R. A. Lasley and F. M. Lewis, ASME Paper No. 53—S-34.

6 "Performance of Free-Piston Gas Generators," by J. J. McMullen and W. G. Payne, ASME Paper No. 53—S-18.

7 "The Free-Piston Type of Gas Turbine Plant and Applications," by J. J. McMullen and R. P. Ramsey, ASME Paper No. 53—S-13.

8(*a*) "Interurban Trains for Argentina," *Diesel Railway Traction*, February, 1952, p. 35.

(*b*) "High-Speed Trains for Norway," *Diesel Railway Traction*, March, 1952, p. 66.

(*c*) "Express Trains for Turkey," *Diesel Railway Traction*, April, 1952, p. 85.

(*d*) "Express Trains for Spain," *Diesel Railway Traction*, July, 1952, p. 182.

(*e*) "The Multi-Car Diesel Train in Europe," *Diesel Railway Traction*, March, 1953, p. 61.

(*f*) "Diesel Traction in Holland," *Diesel Railway Traction*, December, 1952, p. 295.

(*g*) "Diesel Traction in Greece," *Diesel Railway Traction*, September, 1952, p. 223.

(*h*) "Diesel Traction on Italian State Railways," *Diesel Railway Traction*, September, 1953, p. 193.

9 "What Are the Causes of Hot Boxes?" by M. A. Pinney, *Railway Age*, vol. 155, March 4, 1953, p. 54.

10 "N&W Demonstrates How Hot Boxes Can Be Controlled," *Railway Age*, vol. 155, June 15, 1953, p. 103.

11 "How Santa Fe Reduces Hot Boxes," *Railway Age*, vol. 155, July 27, 1953, p. 51.

New Extrusion Techniques Developed

Extrusion presses are being utilized to produce longitudinally tapered, step, and multishouldered extrusions, as well as combination die forgings and extrusions. Automatic operation and improved presses are discussed

By H. Albers,[1] G. Krause,[2] and A. Greensite[3]

Loewy Construction Company, New York, N. Y.

One of the many reasons for the wide recognition of the extrusion process in recent years is the realization that metal shapes fabricated by this process acquire a combination of properties afforded by no other means. The chief advantages are in the inherent ability of the process to produce, in a rapid and economical manner, parts of excellent physical properties and high dimensional accuracy, requiring little or no subsequent machining. The extrusion process is especially suitable for mass-production methods. Rod, strip, hexagons, squares, tubes, and an innumerable variety of solid and hollow shapes can be produced on the same press, by merely changing the die.

Heretofore, extensive use of the extrusion press as a means of fabrication was confined chiefly to the nonferrous industry. Primarily this was so because of the fact that lead, tin, and aluminum alloys can be extruded at comparatively low temperatures, generally less than 900 F, and at moderate unit pressures. In addition, these alloys retain their plasticity for a comparatively long period—a prime requisite for successful extrusion using the earlier slow-acting presses. This was accomplished by the simple expedient of heating the container. Refinement of technique, and the installation of presses of increased capacity, established the extrusion process as a primary source for the production of nonferrous shapes.

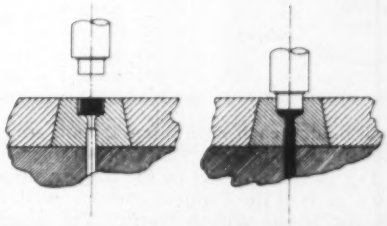
First Extrusion of Steel

The first successful extrusion of steel was accomplished in this country about 25 years ago. This was made possible by the development of the high-speed hydraulic press and advances in metallurgy which provide alloys for tools capable of withstanding pressures up to 140,000 psi at temperatures in excess of 2200 F. Of equal importance are the improved methods of lubrication and salt-bath furnace for preheating billets to 2300 F, in a scale-free condition (1, 2).[4]

Further significant advances in the art of extrusion were made in the design of the presses for the Air Force Heavy Press Program. At present, the largest extrusion press in this program is one of 14,000 tons capacity. Designs have been completed for presses of 20,000 and 25,000 tons capacity. The need for presses of such capacity was first recognized by aircraft engineers, who constantly seek materials with higher strength-to-weight ratios.

Current Extrusion Practices

Poppet Valves. A unique application of the extrusion technique has been used to produce poppet valves for internal-combustion engines (3). A round steel bar, $1^1/_4$ in. diam and $^{15}/_{16}$ in. long, is heated to 2000 F in a gas-fired furnace and placed in a die, shaped as shown in Fig. 1(*a*). The punch then advances to extrude the metal through the die orifice, Fig. 1(*b*). The unextruded



Figs. 1(*a*) and (*b*) Combined forging and extrusion—poppet valve

portion, shaped by the punch, conforms to the contour of the die cavity. No subsequent machining, other than cutting to size, is necessary.

This operation, which is carried out on a 300-ton press, is interesting chiefly in that it is one of the earliest examples of combined forging and extrusion, and is, in effect, a scale-model representation of one of the newest techniques, the extrusion of hollow propeller blades.

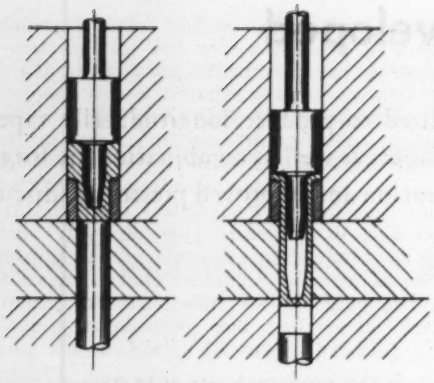
Projectile Shells. A variation of the foregoing process is used in forming projectile shells from round billets (4). The essentials of this method are shown in Fig. 2(*a*). A billet is placed in a container and under the pressure of a mandrel the metal is forced into the die ring and assumes a corresponding shape. In effect, this is a closed die-forging operation. Next, the backing ring is removed and extrusion proceeds as shown in Fig. 2(*b*), producing a hollow formed shell (5).

Turbine Blades. A method recently devised for the extrusion of turbine blades (6) has several unique fea-

---

[1] Chief Engineer.
[2] Chief Designer.
[3] Design Engineer.
[4] Numbers in parentheses refer to the Bibliography at the end of the paper.

Contributed by the Aviation Division and presented at a joint session of the Aviation Division and Research Committee on Metal Processing at the Annual Meeting, New York, N. Y., November 29-December 4, 1953, of The American Society of Mechanical Engineers. Condensed from ASME Paper No. 53—A-128.



Figs. 2(*a* and *b*) Combined forging and extrusion—shell forming

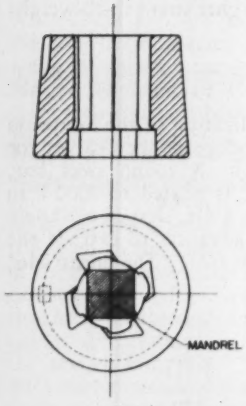


Fig. 3 Combined forging and extrusion—turbine blades

tures. Four blades, each with integral root, are extruded simultaneously in a specially shaped container or die as shown in Fig. 3. The walls of the die are shaped into four recesses, each of the required contour, with the root section shown at the widest point. The mandrel has an approximately square shape and, in advancing, extrudes the billet into the die recesses which, in conjunction with the mandrel profile, produce a blade of the desired contour. A closure plate, which has acted to confine the extrusion within the die, is then moved out laterally and the mandrel ejects the blades out of the press.

Dimensional accuracy of the blade profile is excellent; the surface has a very smooth finish and physical properties are triaxially uniform. The process can be applied to monel, austenitic, and stainless steels, as well as the nonferrous metals.

Step Extrusions. Step extrusions are being produced today in a rudimentary fashion on existing presses. A typical setup is shown in Fig. 4. A pressing stem extrudes the billet through the die orifice and over the mandrel in the manner of a normal direct extrusion. At a given point in the stroke, the extrusion is stopped, and a bolster plate of horseshoe shape is withdrawn, permitting the removal of the split die. A new die is then inserted, the bolster plate is replaced, and the extrusion is permitted to proceed thereby producing the "step" extrusion.

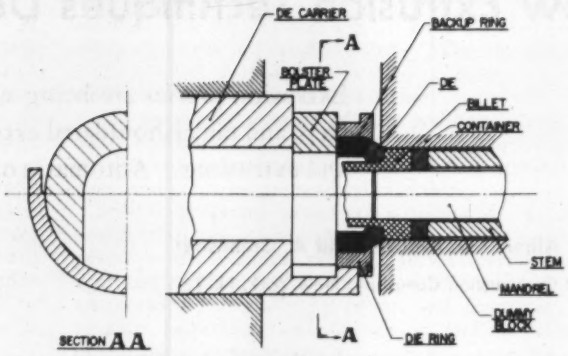


Fig. 4 Arrangement for step extrusion

The obstacles to the development of this system on a production basis are obvious. The primary objection, of course, is the time consumed in interrupting the cycle and changing dies. In many cases, an even greater objection is the necessity for withdrawing the billet and reheating it in the furnace to regain the plasticity necessary for extrusion. While some of the nonferrous metals could be "step-extruded" without the necessity of a reheat, a great many are in the doubtful class; and in the case of the ferrous alloys, a step extrusion by the method described is an impossibility.

Future Trends and Developments

As the need developed for a more completely automatic system of step extrusion, a method was devised by engineers, of the authors' company, whereby the dies could be changed automatically with a minimum of cycle interruption. This system has been incorporated in the design of the company's 20,000-ton extrusion press.

This system shows great promise in the field of aluminum extrusion. Since the required billet temperature for aluminum is low, as compared with steel, for example, and since its plasticity is retained for long periods by container heating, the prospects in this direction are most favorable. Subsequent adaptations of step extrusion to steel must await further data before a reliable evaluation can be made.

Fabricating Propeller Blades. The installation of the 12,000-ton extrusion press at Curtiss-Wright Corporation will reveal a radically new method for the fabrication of propeller blades. Experiments conducted by that company had explored the possibility of fabricating a hollow-blade propeller with integral shank by the extrusion process. The tests were conducted on a 5500-ton extrusion press at the Air Force Plant in Adrian, Mich. A 10-ft propeller blade was extruded from a 320-lb alloy-steel billet. The extruded blade had excellent physical properties, smooth finish, and required only a minimum of subsequent machining. The 12,000-ton press will accentuate these advantages, mainly in the ability to extrude heavier sections and at higher extrusion-reduction ratios.

One of the salient features of an extrusion press is its versatility. The 12,000-ton press, for example, could

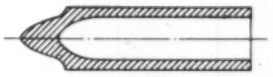


Fig. 5 Combined forging and extrusion—section

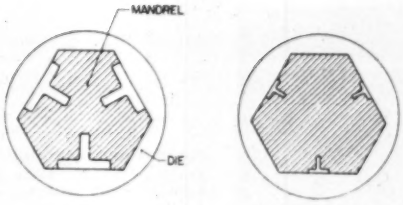


Fig. 6 Extrusion—setup for longitudinally tapered T sections

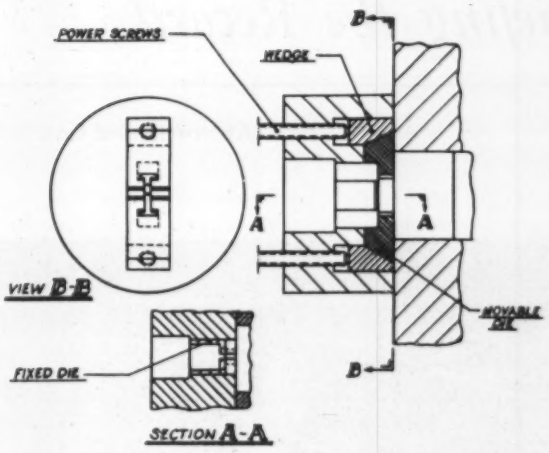


Fig. 7 Extrusion—movable-die arrangement for longitudinally tapered I sections

be used not only for propeller extrusion, but for normal and inverted extrusion, hollow extrusion, and internal taper extrusion. However, some of the most significant developments will be forthcoming when exploring the possibilities of combined forging and extrusion on a heavy press. The ram and stem could be utilized in conjunction with a closed die cavity to form a predetermined forged shape, following which the extrusion could proceed past an extrusion die in the normal manner. A shape that can be fabricated in this manner is shown in Fig. 5.

Extruding Intricate Shapes

Some unique ideas have been advanced recently to produce extruded sections varying in the longitudinal direction. One such design is shown in Fig. 6. In this method (7), recesses whose cross sections vary along the length of the mandrel are used to produce simultaneously three extrusions of T-shape which taper longitudinally. This is accomplished by moving the mandrel relative to the die as the billet is extruded. Obviously, a great many sections, other than the T-shape could be produced by this method.

Split-Die Technique. Perhaps the most radical departure from conventional extrusion technique is embodied in the design shown in Fig. 7. This scheme (8) utilizes split dies that can be moved laterally during the course of the extrusion to produce a longitudinally tapered section. The figure illustrates the arrangement at the beginning of the cycle. The up and down motion of the split dies is controlled by the power screws acting on the dies through the intermediate wedges. The motion of the power screws (and hence the dies) may be controlled by various means. The fixed die is attached rigidly to the die carrier and provides a backup surface to prevent extrusion of metal past the gap opened by the moving split dies. In the illustration shown, the dies are shaped to produce an I-section whose final shape is as shown in Fig. 8.

By means of any or a combination of the foregoing methods and their variations a wide variety of tapered extrusions can be produced.

Fig. 8 Extrusion—longitudinally tapered I section

Conclusion

Significant advances in the development of the extrusion process have stemmed from the impetus of the USAF Heavy Press Program. While some of the improvements described will be realized only when the heavy presses go into operation, others are now being performed on a smaller scale by adapting existing equipment. No doubt, knowledge gained from actual operation of the new heavy presses will stimulate further ideas from the engineers in the field of metal forming. Already the process of combining extrusion and forging is attracting attention.

Aircraft designers, in particular, are awaiting the production of large extrusions (and die forgings) which will give them the advantage of stronger, yet lighter components for the latest high-performance aircraft. The demand for superior methods of metal forming, together with lower production costs, will be filled, we believe, by these new techniques and machines.

Bibliography

1 "Extrusion Method of Manufacturing Tubes," by H. Lorant, MECHANICAL ENGINEERING, vol. 69, 1947, pp. 471–474.

2 "Latest Developments in Extrusion of Metals," by E. Loewy, *Iron and Steel Engineer*, vol. 29, April, 1952, pp. 65–70.

3 "The Extrusion and Annealing of Chevrolet Motor Valves," by J. B. Nealy, *Heat Treating and Forging*, vol. 22, 1936, pp. 523–524.

4 British Patent No. 469,550.

5 "Extruded Steel Forgings," by E. F. Cone, *Steel*, vol. 94, May 7, 1934, pp. 25–27.

6 British Patent No. 459,742.

7 British Patent No. 533,082.

8 United States Patent No. 2,365,482.

Briefing the Record

Abstracts and Comments Based on Current Periodicals and Events

J. J. Jaklitsch, Jr., Associate Editor

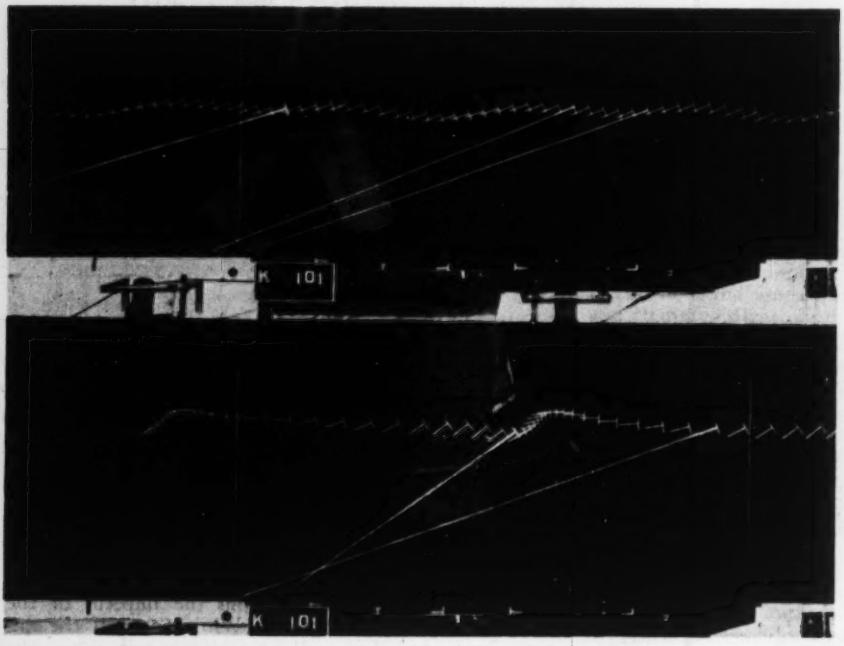


Fig. 1 Interrupted-light photograph of users carrying Army Signal Corps obstacle detector for the blind with beam pointed downward to search for steps and curbs. A T-shaped piece of Scotchlight on the case reflects to the camera light from a spotlight mounted over the camera lens. A single flash shows the wearer and the position of the Scotchlight. Note the variation in oblique distance from the "T" to the level ground merely due to arm swing and body undulation. Upper photo shows care in restraining motion; lower photo illustrates casual gait.

Electronic Sensory Aid

MANY engineering as well as psychological and medical problems arise in overcoming the loss of eyesight, according to a symposium on Communication Aids for the Blind at the 120th Meeting of the American Association for the Advancement of Science. In the conceivable future, no device can really replace vision, which provides 95 to 98 per cent of the information about the external environment reaching the brain of a sighted individual. Fortunately, information theory, ingenious design, sound judgment, and teamwork between engineers and other specialists give hope of practical guidance devices for the blind in the next five years.

Interrupted-Light Technique

Fig. 1 graphically illustrates one such example of teamwork of agencies and professional specialties in studying one phase of the design of an improved device for detecting curbs, steps, and similar hazards. The picture was used at the symposium by T. A. Benham, a blind assistant professor of physics at Haverford College, Haverford, Pa., to illustrate his report on tests for the Veterans Administration of an obstacle detector designed by the Army Signal Corps in a program co-ordinated by the National Research Council. The "interrupted-light" technique used in Fig. 1 was developed by the College of Engineering, New York University, from the earlier stroboscopic methods for studying walking in order to improve artificial limbs. This interrupted-light photograph clearly indicates the difficulties inherent in detecting steps by measuring the oblique distance from the obstacle detector to the ground. Unfortunately, this distance varies continually due to the swing of the arms during walking and the vertical undulations of the obstacle detector with every step.

The original Signal Corps obstacle detector, Figs. 2 and 3, in effect, sent a beam of light from one lens at the bottom of the box, just as if it contained a flashlight. When this light struck either the floor or an obstacle, it made a bright spot. A photocell in the obstacle detector "looked" forward and downward through a rotating coding disk and a second lens at the top of the box. As the obstacle came closer, the spot appeared at a different angle through the second lens, and this change of angle formed the measure of distance just as in optical range finding. The Signal Corps detector was ingeniously designed to provide coding of pulses of vibration of its handle to transmit information regarding the distance to the bright spot. The device originally was intended for detecting vertical obstacles such as walls, and func-

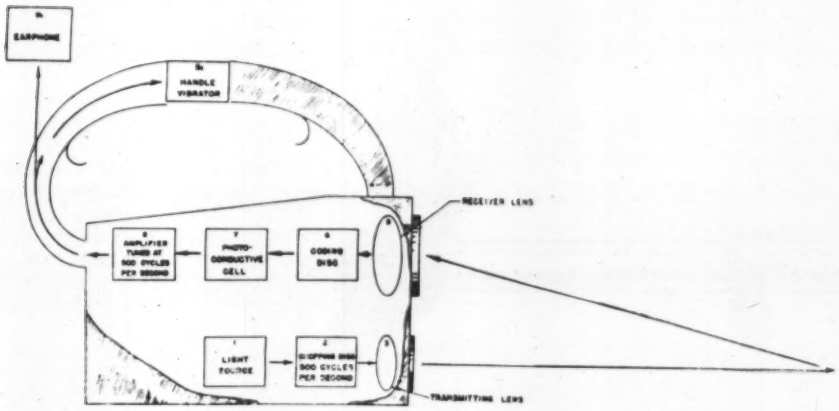


Fig. 2 Functional drawing of electronic sensory aid. The device, for use by the blind, warns the user of discontinuity in the terrain and of obstacles in his path.

tioned satisfactorily for that purpose, as shown in Professor Benham's tests. However, by grasping the handle to carry the box at an oblique angle, it could also be used to detect stepdowns because of the sudden change of the distance to the spot of light on the ground when the beam passed over the edge of a curb or step, forming the bright spot on the pavement farther ahead and lower than the edge of the sidewalk.

Stepdown Detection

This solution for measuring stepdowns at first seems theoretically satisfactory. During field tests, however, difficulty was encountered because the detector provided a constant stream of information about the distance to the spot of light on the ground. Even if the detector could be moved at a steady height from the ground and at a constant angle, the user would be annoyed by the constantly repeated but unnecessary signal of a fixed distance. The user was forced to pay attention carefully and constantly while looking for a sudden change in the signal, indicating an increased distance to the ground, presumably as a result of passing over the edge of a step.

This is equivalent to having a telephone jangle constantly but answering only when there is a slight change in the ringing frequency. The problem is complicated by the fact that, as shown in the interrupted-light photograph, even with careful attention to holding the arm steady and minimizing the angular swings, the slant distance to the ground during normal walking on a level surface has a periodic variation which causes modulation of the steady signal. The user must learn to distinguish between the rhythmic change due merely to walking and the sudden, but fleeting, change due to presence of an actual curb or step. Correspondingly, he must distinguish a sudden shortening in the distance to the spot indicating an actual obstacle. A further hazard is that, when used in this manner, hazards cannot be detected more than a few feet ahead. Therefore there is inadequate time for the user to execute avoidance maneuvers.

Professor Benham's tests indicated that in spite of these difficulties, 41 of 67 blind subjects of various ages and degrees of experience were able to attain fair to excellent use of the guidance device; in fact, eight were able to cover an unfamiliar obstacle course at the same speed or even faster than the sighted trainer. Results of the field tests were so encouraging that under Veterans Administration sponsorship Professor Benham and a subcontractor, Biophysical Instruments, Inc., are developing an improved model using transistors and other miniaturized components.

Stepdown-Detector Development

The difficulties in detecting steps, emphasized in Professor Benham's tests, have encouraged the development of separate stepdown and obstacle detectors. Dr. Clifford Witcher, under sponsorship of the Armed Services, is working at the Research Laboratory of Electronics, Massachusetts Institute of Technology, on a separate stepdown detector. His principle is the most promising thus far advanced. In this case, an oscillating light beam passing over the edge of a step casts a shadow on the ground below, which can be detected from a viewing photocell and lens mounted above the projecting lens. The photocell causes an alarm, probably again through vibration of the handle.

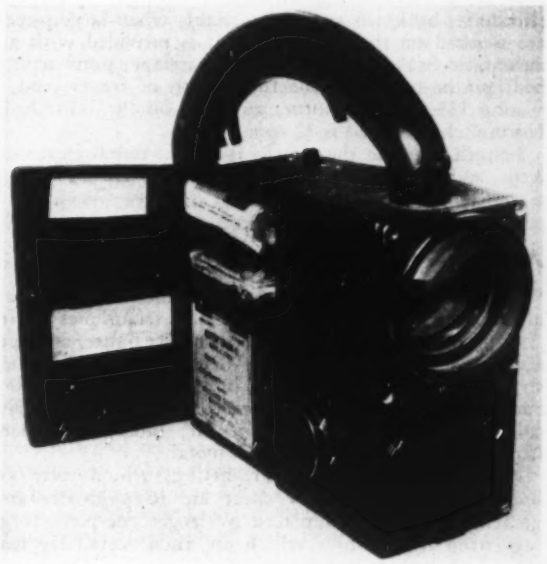


Fig. 3 U. S. Signal Corps Electronic obstacle-detecting device for the blind

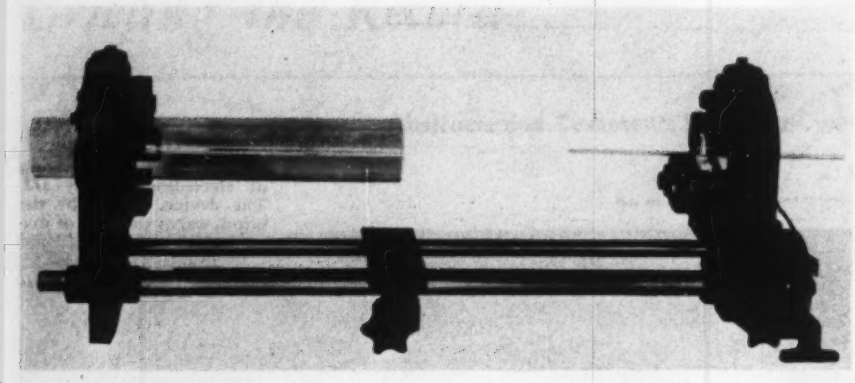


Fig. 4 Bethlehem Lab-Lathe for specialized glasswork

Glass Lathe

A NEW type of glass lathe, known as the Bethlehem Lab-Lathe and manufactured by the Bethlehem Apparatus Company, Inc., Hellertown, Pa., is said to be the first of its kind designed for specialized glasswork in the laboratory and certain types of production operations. It can be used to make ring seals, tees, flanges, tapers, glass fusings, closures, and a variety of repairs.

A sleeve-grip chuck permits quick setups of practically all forms of glasswork without elaborate accessories. Tubing of any length up to 100 mm in diam can be mounted through the spindle. Extension bars grip a variety of glass shapes in sizes up to 12 in. in diam with eccentric settings made as required. The unit can be adapted for use as a vertical lathe.

Extra accessories are not needed for this lathe except for special purposes or where large-scale production of identical parts is desired.

The apparatus is constructed for exact and permanent centering and for greatest possible operating convenience. The floating tailstock with finger-tip control eliminates backlash and is detachable when large pieces are worked on the headstock. It is provided with an automatic brake, floating burner carriage, nonwarping bed, pinion-bar drive the full length of travel, and a $^1/_{12}$-hp 115-volt a-c motor, mounted on the lathe bed. Normal chuck speed is 32 rpm.

Length between the chucks is 36 in., radial clearance 8 in., and the through-spindle diameter, 4 in.

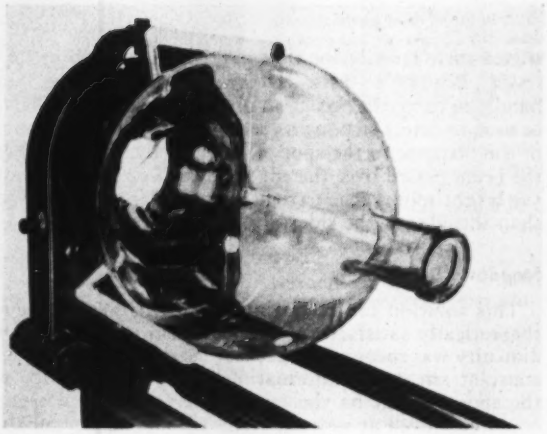


Fig. 5 Sleeve-grip chuck for Bethlehem glass Lab-Lathe

Aircraft-Production Techniques

A DISTINCT revolution is coming about in the way aircraft are made—starting as do most techniques in aircraft production with higher-performance fighter aircraft, according to the Society of British Air Craft Constructors. The change ahead lies in an ever-increasing emphasis on machining one-piece structures from the solid, rather than, as at present, fabricating them from a number of pieces of sheet metal.

Already in fighter aircraft, fittings which were assembled from light-alloy sheet are to a greater and greater extent being replaced by larger one-piece forgings from light alloys which are then accurately machined to the required design.

The change has come about because designers today are calling for razor-thin wings of great strength. These are best built by switching from the existing type of fabricated structure—the wing-spar with wing panels strengthened by members riveted to them—to a new structure in which the load is spread over a thick skin with any strengthening members required formed into one piece with the skin by forging and machining.

A development of this method could be wings formed in halves from slabs or forgings of light alloy, machined internally to form ribs, spars, fittings, and skins all in one piece. The two halves would then be joined together and the outside surface contour-machined all over to give a far more accurate finish than is possible by traditional methods.

Airframe Structure

Parallel with this structural change in wing design, other parts of the airframe are also progressively benefiting from the new one-piece technique—for example, main frame members, engine supporting frames, and the like.

The advantages of machining from the solid as compared with generally used existing methods are as follows: Greater strength, weight for weight, than the riveted structure and the saving in the "cost-time-complication" curve, as it is sometimes called.

Time and Cost Saved

Many production experts in the Aircraft Industry view with concern the increasing number of man-hours that are now required to produce new types of aircraft. Short cuts and aids to production must be sought if costs are not to rise still further. For instance, in the 1939–1945 war, a fighter-airframe took from 4500 to 10,000 man-hours to build. The equivalent jet aircraft of today takes 30,000 to 40,000 man-hours.

However, the coming revolution in fabricating methods, with the switch to large one-piece structures, may mean that the top of the "complication" curve has been reached. The new technique, although involving more machining time, reduces the number of parts necessary for each aircraft and so can cut tooling and assembling time and cost.

If the right production machines can be designed for these new methods, it will be possible for complicated parts to be machined in quantity direct from a master line drawing on metal or even from mechanical information fed into the machine by an electronic brain.

Historical Pelton Wheels

THE impulse turbine as now used in high-head hydroelectric plants throughout the world is commonly referred to as the Pelton wheel—in honor of Lester Allen Pelton, who first patented the idea of placing a center splitter in the buckets of the turbine. This idea of Pelton's constituted the first step in placing the impulse wheel in the position that it now holds as an efficient prime mover. Some historical facts and photos on two of Pelton's early wheels are given by J. W. Johnson, Professor of Hydraulic Engineering, University of California, Berkeley, Calif.

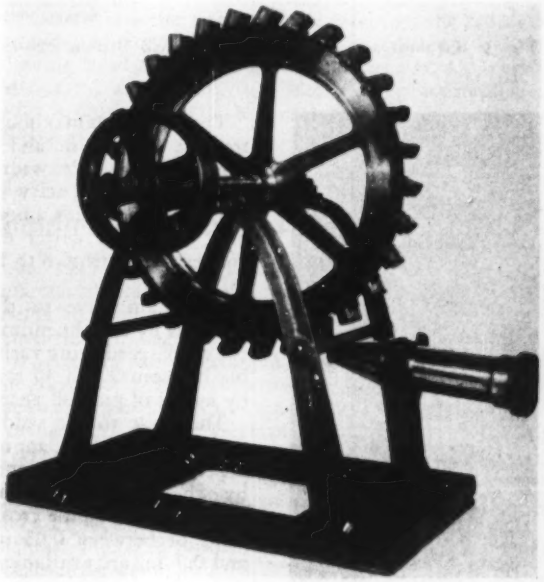


Fig. 6 Small wheel constructed from patterns supplied by Lester A. Pelton and tested at the University of California in 1883. Wheel is now on display in the Mechanics Building at the University.

Fig. 7 First water wheel constructed by Lester A. Pelton. Note hole in casing where nozzle was held in position. This wheel is now on display in the Sutter's Fort Museum, Sacramento, Calif.

Professor Johnson writes that during the 1870's, Pelton, a millwright, had a small shop in the heart of the California mining region at Camptonville in Yuba County. He was engaged in constructing equipment for the mines and became interested in the crude impulse or "hurdy-gurdy" wheels then in use. His first attempt at constructing a water wheel was a small unit built of wood and old oyster cans, and it was of the hurdy-gurdy type—that is, a series of flat plates supported between two disks. The jet of water impinged on these flat plates and caused the wheel to rotate.

The encouragement of the successful operation of his first wheel inspired Pelton to attempt to improve the hydraulic efficiency of the impulse wheels then in use. His persistence eventually paid off with the development of the "Pelton bucket" and the granting of a patent in October, 1880.

Perhaps the first systematic tests on the hydraulic efficiency of the Pelton wheel were made in 1883 at the University of California, on a small wheel which was constructed from patterns supplied by Pelton. This wheel had a pitch diameter of $15\frac{1}{2}$ in. The report on these series of tests constituted the first Bulletin of the Department of Engineering. In these tests the highest efficiency attained was 82.5 per cent with a $\frac{3}{8}$-in. nozzle operating under a head of 50 ft. This efficiency was about twice that which was realized from the crude hurdy-gurdy wheels then in use.

Since the day of the two small wheels described by

Professor Johnson, research and development by turbine manufacturers have placed the impulse wheel as the prime mover in high-head hydroelectric plants throughout the world. In fact, the highest-head plant in North America is located only a few miles north of Camptonville, Calif.—the birthplace of the Pelton Wheel. This is the Pacific Gas and Electric Company's Bucks Creek plant on the North Fork of the Feather River in which water under a static head of 2561 ft spins the Pelton turbines.

Other articles published by ASME on the Pelton Water Wheel include the following: "The Pelton Wheel," by E. M. Breed, MECHANICAL ENGINEERING, April, 1930, pp. 386–389; "The Pelton Water Wheel," by W. F. Durand, Part I, MECHANICAL ENGINEERING, June, 1939, pp. 447–454, Part II, July, 1939, pp. 511–518; and "Efficiency Analysis of Pelton Wheels," by Robert Long, Trans. ASME, vol. 66, 1944, pp. 527–538.

Gear-Shaving Machine

A TURBINE gear-shaving machine, said to be the world's largest, has been designed and built by David Brown Machine Tools Ltd., Manchester, England. It is now in operation at the Clydebank shipbuilding works of John Brown and Co. Ltd. Weighing 130 tons, the machine can, if necessary, accommodate turbine wheels of 220 in. in diam, weighing 100 tons.

This machine was installed for the treatment of marine main propulsion wheels and is being used in conjunction with a David Brown 48-in. pinion shaving machine, which is employed for shaving H.P., I.P., and L.P. pinions. The wheel-shaving machine is designed for "crowd" shaving, which is a superfinishing process for removing the minute indulation inherent in gears cut by the hobbing process.

The cutter head of the machine is equipped with a brake on each side of the cutter so as to permit selective shaving which may be necessary to obtain something of the order of a 95 per cent bearing across the face width of the gear, allowing for slight relief at the ends. In cases where a precalculated amount has to be allowed for the torsional deflection of the pinion under full load, the necessary adjustment in the shaving process is carried out on the pinion machine; this usually applies to H.P. pinions of comparatively small diameter.

A feature of the 220-in. machine is that it is fitted with a pinion-mounting bracket at the rear, allowing the machine to be used as a testing bed so that the tooth marking can be determined without removing the large wheel from the shaving machine.

The machine is 33 ft long with a fore and aft dimension of 35 ft and a total height of 16 ft. The bed is sunk into the ground and the layout provides easy access to the machine.

The main bed comprises two heavily ribbed castings tenonned and bolted together, on which are mounted the shaving-head slide bed, the wheel pedestals, and the bracket for the pinion pedestals. By adjusting the shaving-head slide bed on the main bed of the machine, gears of any center distance from 48 in. up to the maximum diameter of 220 in. can be accommodated.

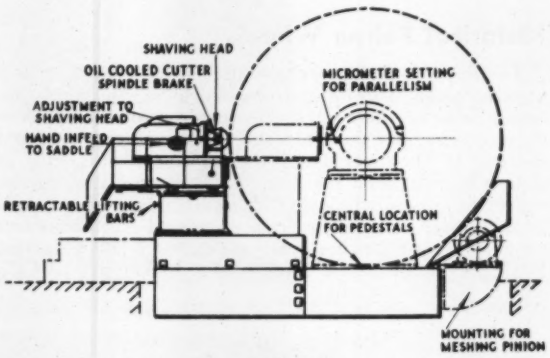


Fig. 9 General arrangement of the David Brown 220-in. gear-shaving machine

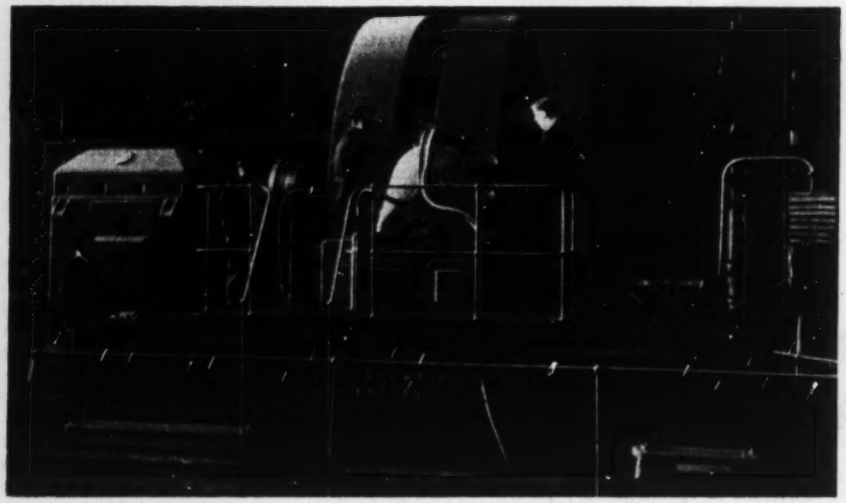


Fig. 8 General view of the 220-in. gear-shaving machine, showing the operating platform. When finally installed, the lower section of the main bed will be below ground level.

The cutter has maximum traverse of 100 in. and a similar wheel face width is within the capacity of the machine. With a bore of $2^1/_2$ in. the cutter diameter ranges from 8 to 14 in.

The main drive to the wheel is by a 30-hp motor, the work speed being variable between 7 and 30 rpm by means of pick-off gears.

The drive to the saddle feed motion is by an independent 6-hp motor and, by the use of pick-off change gears, saddle cross-feeds of between 0.03 in. and 0.7 in. are available.

A self-contained and independently motor-driven pump, strainer, and oil-reservoir unit is provided.

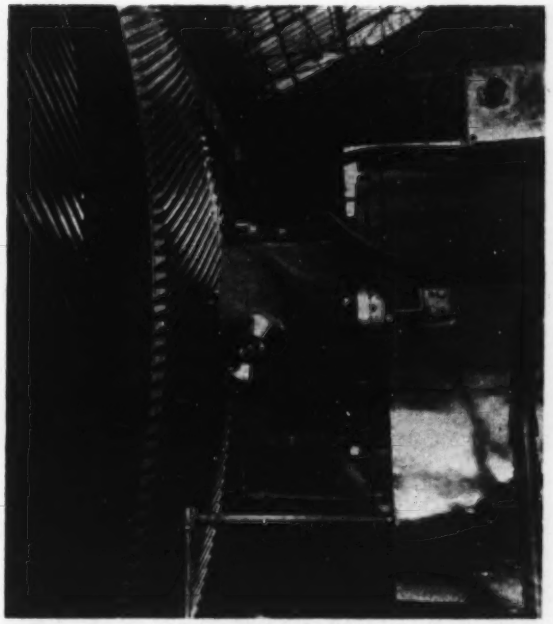


Fig. 10 Close-up of the 220-in. gear-shaver, showing shaving cutter in operation

A noteworthy feature is that the operating drive is applied to the wheel which is being shaved. There is no rotational drive to the cutter, which is driven by contact with the main wheel. The power drive to the cutter is solely for the purpose of controlling the traverse of the saddle.

Small primary wheels can be accommodated by the provision of appropriately proportioned pedestal supports mounted on the large pedestal bases.

To facilitate the setting of the machine, the saddle is provided with a quick power motion of 36 ipm and the shaving head has a rapid traverse speed of $12^1/_2$ ipm. Movement of the shaving head can be accomplished with a motion of 0.01 in. per revolution of the handwheel.

Interlingua—A New Language

In 1923 an international group of technical men, anxious to simplify the exchange of ideas and developments in science and engineering, organized to overcome the language barrier.

The result was Interlingua, a union of five European tongues, with the peculiarities of each left out. The languages are English, French, Italian, Spanish, and Portuguese. A little German also is included.

Twenty-five years of research by linguistics experts culminated in a book on Interlingua grammar, which is simplified in comparison to the European languages, and a 27,000-word Interlingua-English dictionary, which includes 17,000 technical terms.

Currently being printed is a book using pictures to teach vocabulary entitled, "Interlingua a Prima Vista" (Interlingua at First Glance). An English-Interlingua vocabulary is about half finished.

Publication Begun in 1952

The first publications in the new language were begun in 1952. "Spectroscopia Molecular" is one of them. It is published monthly by Dr. Forrest F. Cleveland, professor of physics at Illinois Institute of Technology, Chicago, Ill.

By using Interlingua, Dr. Cleveland is able to relate developments at Illinois Tech to about 500 other molecular spectroscopists in 22 other countries.

"Most scientists," he said, "may be surprised to find that they can read Interlingua with little reference to the dictionary or grammar."

An example: "Energia es necessari pro toto que occurre in le mundo. In tempores passate le plus grande parte del energia applicate esseva fornite per le fortia muscular del homines e del animales domestic."

The English equivalent is: "Energy is necessary for all that occurs in the world. In past times the greatest part of the applied energy was furnished by the muscular strength of men and domestic animals."

Although at present it is primarily a language to be read, it can be spoken, too, Dr. Cleveland said. But the importance of Interlingua now is its usefulness in the fields of science and engineering.

As Dr. Cleveland, said, "It would be a tremendous step forward if all scientific work could be published in a single language."

About the time of the appearance of "Spectroscopia Molecular," another Interlingua publication was born, "Scientia International." This is a monthly edition of *Science News Letter* published by Science Service as a weekly news service on scientific developments. Chief of the Interlingua division of Science Service is Dr. Alexander Gode.

Theory Behind Interlingua

Dr. Gode presented the theory behind Interlingua in an article entitled, "The Case for Interlingua," in *Scientific Monthly*, August, 1953.

It was summarized in four points:

1 The languages of the world cannot be reduced to one universal pattern. Instead, every language falls into one of many possible molds.

2 The internationalism of the twentieth century is propelled by ideological forces which have originated in the western world. These forces are understandable only in the molds of occidental speech and thought.

3 The languages of the west are so closely related to each other that it is sound to think of them as variations of one-type language which is called Standard Average European.

4 To become international a language must have a force behind it to make it spread; for example, Latin's influence spread through Europe with the Roman colonizing legions, Christianity, and the revival of classical Latin during the Renaissance. The motivating force of language in the twentieth century is science.

The concepts of science, Dr. Gode wrote, emerged in Europe, and the natural supranational language of science is Standard Average European. Interlingua, he concluded, is to date the most satisfactory system of language formed from Standard Average European.

But neither Cleveland nor Gode crusade for a single language for the world or even Western Europe.

For the Illinois Tech physicist, Interlingua fills a

need. "The scientist loses much time in learning to read two or three other languages," he said. "For the greatest possible progress in science it is essential that research workers should know the results of work along similar lines by investigators in other countries."

Dr. Gode feels the same. In his article he asked that languages of nonscientific fields be respected by recognizing that their grammars and vocabularies hold priority in each locality. "Interlingua," Dr. Gode pointed out, "unifies the dialects of the Western world, not the languages of the world."

Atomic-Powered Locomotive

THE reactor for the proposed atomic locomotive, announced February 10 by the University of Utah, Salt Lake City, Utah, is already on the designing boards of The Babcock & Wilcox Company's Atomic Energy Division, according to C. H. Gay, Mem. ASME, vice-president in charge of the division.

Mr. Gay said that the reactor, employing fluid rather than solid fuel, was of extreme interest in the field. "Such reactors have been previously designed, but never for such a heavy demand of energy," he said. "Our studies, based on engineering data collected over the 87 years of our company's existence, convince us that such a reactor can be designed, but we anticipate many problems before the job is finished." Some of the problems, Mr. Gay explained, include arranging for a sufficient amount of heat exchange between the fuel and the pressurized water in the limited space available and the problems of corrosion and of neutron damage. "How well these problems can be overcome will have a great bearing on the efficiency of the power plant of the locomotive, and consequently on how soon it will be built," he said.

Mr. Gay also feels that such a reactor will find uses other than that proposed for it in the locomotive.

Dr. Lyle B. Borst, the University of Utah nuclear physicist who came up with the design for an atomic locomotive, recently presented the results of his study to representatives of railroads and industry.

The proposed locomotive would have the power of at least four diesel units, and would have the pickup of an electric locomotive.

Steam would be obtained from a small atomic reactor, 2 ft wide, 3 ft high, and 3 ft long, yet this atomic boiler would produce as much steam as the largest steam locomotive. Electricity generated by a turbine would turn the wheels.

The locomotive would consist of two 80-ft sections. The first, having 24 wheels, would support the reactor. The second section would carry radiators equal to more than 1000 automobile radiators to get rid of the heat produced by the reactor. The weight would be comparable to that of present-day locomotives.

While the boiler would be only a few feet in size, it would be housed in a massive steel container 4 ft thick and weighing 200 tons. This container would protect the engineer from the atomic rays coming from the boiler.

Dr. Borst said that atomic energy in this field appears to be closer to realization than in other proposed fields. A cost analysis of operating such a locomotive requires information on the price of uranium, which is now secret. However, estimates indicate that the proposed locomotive will compete successfully with diesel power under favorable circumstances.

Fig. 11 First step in making large-size buoy chain is this forming operation, where 25 to 30-ft-long bars are wrapped around a mandrel

Chainmaking

AN ORDER for 14 million lb of buoy chain—the largest single order of its kind ever placed by the U. S. Navy Bureau of Ordnance—is nearing completion by the Round Chain Companies.

This large-size chain is made of $1^1/_2$-in. wrought-iron bars and is for use with antitorpedo and antisubmarine nets in U. S. coastal harbors and in naval stations abroad.

Each link is 9 in. long and weighs 10 lb. Sixty of the huge links are welded together to form a chain 45 ft long, and the companies are turning out an average of 200 completed chains every week.

This big defense order was divided among four of the Round Chain Companies: The Cleveland Chain & Manufacturing Company, Cleveland, Ohio; Round Woodhouse Chain & Manufacturing Company, Trenton, N. J.; Round Seattle Chain Corporation, Seattle, Wash., and Portland, Ore.; and Round California Chain Company, South San Francisco, Calif.

Smaller sizes of welded chain (and all sizes of weldless chain) are made on high-speed automatic or semiautomatic machines. Big chain like this, however, is still dependent on skilled craftsmanship, as it was in Colonial days.

In fact, the basic method is said to have been used as far back as the time of King Solomon, who built the beautiful temple at Jerusalem about the year 1000 B.C.

Chainmaking flourished in England, where for many centuries wrought iron was the primary metal used in the manufacture of chain. Many English families had small chain forges in their back yards, and the women often excelled their menfolk as artisans. The equip-

Fig. 12 The coil is cut on a shear with special knives which lop off the links one at a time and scarf them in the same operation

ment consisted of a coke-burning forge with hand bellows, blacksmith anvil, hammer, and tongs.

The David Round family were prominent among the few pioneers who came from England to America some 90 years ago to start the manufacture of chain on this continent. Their equipment was about the same as they had used in England, except for a small hammer-head gadget which worked on a spring-and-foot treadle suspended above the anvil. This head held a small half-round top tool that was grooved to admit the bar diameter of the chain they were making. On the anvil was fastened securely a bick iron, grooved out the same as the top tool. After the link was lapped and welded together it was placed on the bick iron, with the chainmaker's tongs holding it firmly in place. The chainmaker would then tramp on the treadle, bringing down the top tool to smooth the weld to its proper radii and dimensions.

About 50 years ago the chain industry entered a new era. Instead of forming the links by hand from pieces cut off of a straight bar, they are now formed on a winding machine. Then another machine cuts and scarfs them. Power hammers do the welding. By means of these improvements the output per man-hour has been increased ninefold.

The accompanying photographs, Figs. 11 to 14, taken at the Cleveland Chain & Manufacturing Company, illustrate various operations on the $1^1/_2$-in. buoy chain.

All chain from $^7/_8$ in. up to the largest size (3 in.) is made the same way.

Fig. 13 A heated link is slipped into the end of the chain and closed together by the power hammer. Then it is hammered into shape by dies. The anvil die which closes the weld on the inside of the link is called the nipple die; the top die, on the face of the hammer, closes the weld on the outside of the link to the proper size and radius.

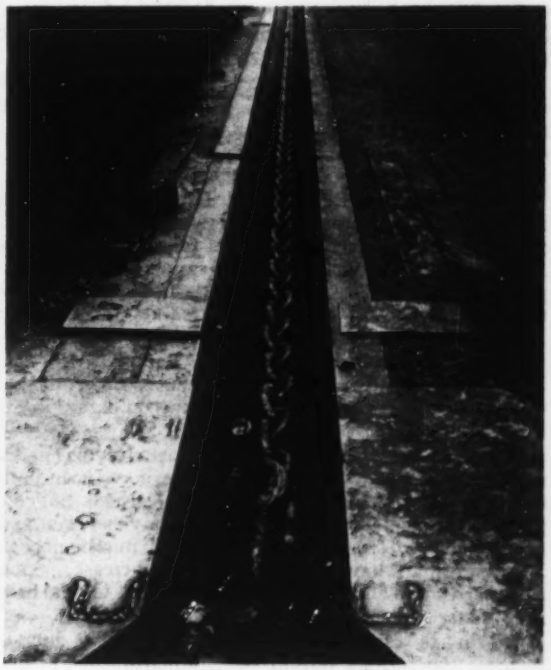


Fig. 14 Before it is shipped, every length of chain is tested to 60,840 lb. The test channel is 100 ft long, so that two lengths of chain may be tested at the same time. At the far end of the test channel is a powerful hydraulic testing machine which exerts the necessary "pull" to prove the chain to test specifications.

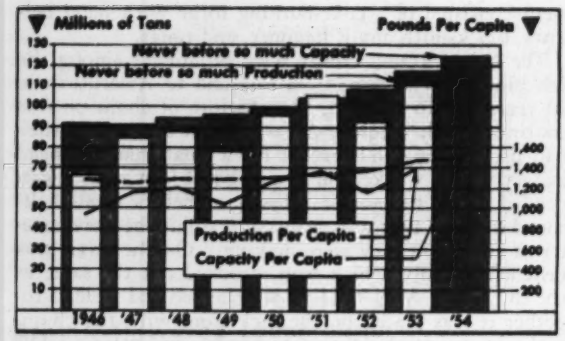


Fig. 15 Despite more people, more steel for each person

U. S. Steel Capacity

THE steel industry of the United States started 1954 with an annual steelmaking capacity of 124,330,410 net tons of ingots and steel for castings, according to *Steel Facts*, February, 1954. This is the highest level ever achieved. It is 6,782,940 tons more than a year ago.

The industry also started 1954 with capacity exceeding production by a comfortable margin for the first time since 1946. But even though operations in early January were around 75 per cent of capacity, a heavy tonnage was still being produced.

For example, with its current record-breaking capacity the steel industry in this country, operating at 76 per cent of the new capacity, can produce approximately 94 million tons, which would be the fourth highest annual output in history. At 72.4 per cent of capacity, output would be 90 million tons.

The latest capacity of the world's largest steel industry is an increase of more than 32 million tons, or 35 per cent, in the eight postwar years. It is the result of the companies' large-scale expansion and improvement programs. It is a gain of over 52 per cent since 1940.

Other producing facilities have been expanded and improved. Blast-furnace capacity went up 2,621,150 tons during the past year and as of Jan. 1, 1954, is rated at 82,001,390 tons annually. It has increased about 47 per cent since 1940. Coke-oven capacity went up over 2 million tons in 1953. Now it is rated at 73,239,540 net tons.

The increase in steel capacity was anticipated by the American Iron and Steel Institute a year ago when it said that "capacity is rising toward an expected figure in excess of 123 million tons."

The postwar increase in steel capacity has been achieved in many ways. New furnaces have been built and many existing furnaces have been enlarged. But construction and enlargement are not the only means of getting more steel production. Scores of improvements, large and small, have contributed to the increase. Some have been small and relatively inexpensive. Others have been costly and complex.

Striving to solve the challenge, "What can be done to increase the furnace output by eliminating delays and melting faster?" the steel companies have taken many steps, such as finding ways and means of reducing the amount of time furnaces must normally be shut down for repairs; addition or improvement of charging machines, resulting in faster charging of raw materials; the use of automatic controls; better refractories; improved furnace design; new soaking pits; and training of personnel.

Incidentally, world steel production jumped approximately 24 million net tons in 1953, to a record level of about 255 million tons, according to *Steel Facts*. The largest tonnage gain over 1952 by far was the 18.5 million ton increase made by the United States. Other significant gains were made by the United Kingdom and Russia. But most of Continental Free Europe lost ground.

Steel production of 111.6 million tons in the United States in 1953 was about 44 per cent of the world total.

Russian output is reported to have risen 3.2 million tons to about 41.8 million net tons. The latter figure is over one third as large as output in the United States and slightly more than twice the output of Britain, third largest producer. The output of nearly 112 million tons in the United States was about 70 million tons greater than in Russia. This margin is substantially higher than the 50 million-ton differential in the nineteen-twenties.

Synthetic-Liquid-Fuels Policy

THE future policy of the Bureau of Mines synthetic-liquid-fuels program will emphasize fundamental laboratory and pilot-plant research on producing liquid fuels from coal and oil shale, according to the Department of Interior.

It is pointed out that in lending active support to fundamental work in laboratory and pilot-plant operations, the Department will continue to co-operate with private industry through co-operative projects and frequent technical discussions. In addition, the Department will encourage private industry to assume primary responsibility as soon as any project reaches an advanced developmental stage.

Outline of Policy

The specific procedures outlined by the Department for the research include the following:

1 Coal-to-oil research program. (*a*) Work is to be continued on direct hydrogenation of coal and on the synthesis of liquid fuels from gasified coal within the Bureau's laboratory facilities. (*b*) Pilot plants will be confined to small-scale facilities of the type needed to supplement laboratory work.

2 Coal-gasification program. (*a*) Laboratory research and pilot-plant runs will be continued.

3 Oil-shale programs. (*a*) No further large-scale mining development will be undertaken. The oil-shale mine at Rifle, Colo., will be operated primarily to supply material for the retorts. Development of a new mining procedure on paper is authorized for the current fiscal year. (*b*) Laboratory research on oil shale will be continued. (*c*) Retorting of oil shale at Rifle, Colo., will continue until the practicability of the Bureau's new retorting equipment has been reasonably demonstrated. Large-scale shale-oil-refining work will be discontinued.

The plans outlined are in keeping with the earlier decision to discontinue the operation of demonstration plants and to confine the Department's research and development programs to those that industry cannot be expected to undertake at this time. In addition, they

follow the historic Bureau of Mines policy of dropping research and development projects as soon as they have reached an industrially competitive status.

Under authorization of the Synthetic Liquid Fuels Act, the Bureau of Mines has operated coal-to-oil facilities at Bruceton, Pa., Morgantown, W. Va., and Louisana, Mo., and oil-shale installations at Rifle, Colo., and Laramie, Wyo. In co-operation with the Alabama Power Company, it also conducted experiments on the underground gasification of coal at Gorgas, Ala.

Future Coal-to-Oil Research

In the future coal-to-oil research program, work at Bruceton will cover the direct hydrogenation of coal and the synthesis of liquid fuels from gasified coal, while the work at Morgantown will be devoted to coal gasification with laboratory research and pilot-plant operations.

Laboratory research and pilot-plant development work on oil shale and shale oil will continue at Laramie, where the Bureau's Petroleum and Oil Shale Experiment Station is located, and at Rifle, where a Bureau-developed gas-combustion retort was completed early this year.

The Department suggested that the Bureau of Mines make a paper study of a new mining system at Rifle to determine whether sufficiently improved methods can be devised to require testing before establishment of a large-scale industry. Work on continuously operating retorts at Rifle was authorized to permit development of a reasonably satisfactory process for use by a commercial oil-shale industry.

Underground Gasification Discontinued

Work on the underground gasification of coal was discontinued in June, 1953, after the third experiment, because it was felt that a full-scale operation was needed and that, in view of the desire to reduce the budget, it should not be undertaken at this time.

The coal-to-oil demonstration facilities at Louisiana, Mo., have been returned to the Army for disposal.

The Synthetic Liquid Fuels Act, enacted in April, 1944, authorized the Department of Interior, through the Bureau of Mines, to conduct research in laboratories, pilot plants, and demonstration plants on the production of synthetic liquid fuels from coal and oil shale among other raw materials. The legislation was twice extended, to continue the program to April, 1955.

Management With Automatic Production

(*Continued from page 320*)

in automated industry's wheel. While they may be developed from subordinate ranks, their jobs will not permit preoccupation with technical or personnel details in any one field. They must be familar with finance, accounting, and, above all, be able to tap the brains and abilities of their specialist assistants or department managers, securing their co-operation with themselves and with each other. Decision-making must be scrutinized carefully with an eye to keeping as much as possible at the interdepartmental level. Speed will be as important in the big decisions as in the small ones.

A new manufacturing enterprise will be the product of the product executive's co-ordination of the special talents of his assistants in the meetings of the plant problem-solving group. The board of directors will choose their product executives carefully, for in them must be vested most of the responsibility for attaining the company's financial objectives.

Conclusion

The true automatic factory may not be built for some time although steps are presently being taken in its direction. Before it is built the separate fields of business management, systems engineering, computer theory, and operations research must be united by those who can visualize an entire factory in terms of its final product family and can gather around them the necessary specialists who, working together, will create a structure of automation capable of complete end-point computer control.

Management in automatic industry must be as streamlined and progressive as its environment. Concentration of new skills in fewer workers will require intelligent versatile plant executives who can rub elbows with scientists and technicians and talk their language.

The management organization discussed in this paper is that of a hypothetical automatic factory, unlikely to be realized for some time. It will evolve from bringing specialists more and more into the line organization and developing in them the required characteristics of teamwork and perspective.

Acknowledgment

The author would like to acknowledge the assistance given in the preparation of this paper by Mr. R. K. Mueller, general manager, Mr. Robert Crawford, manager of business research, and Mr. Charles Fawkner of the engineering department, all of the Monsanto Chemical Company Plastics Division.

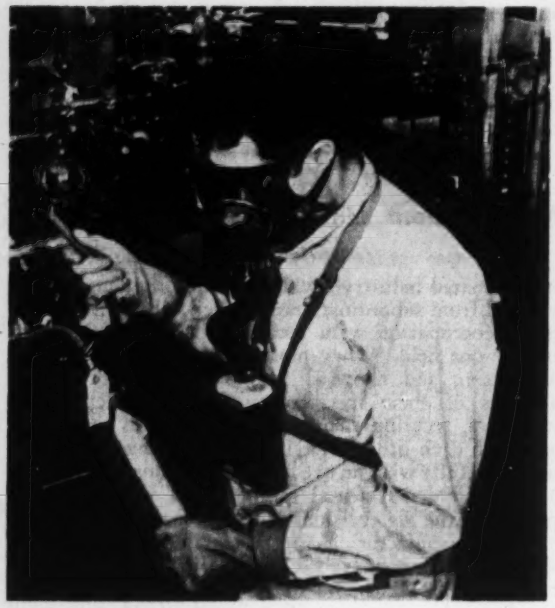
How to Obtain Further Information on "Briefing the Record" Items

Material for these pages is assembled from numerous sources and aims to cover a broad range of subject matter. While few quotation marks are used, passages that are directly quoted are obvious from the context, and credit to original sources is given.

This material is abstracted from: (1) technical magazines; (2) news stories and releases of manufacturers, Government agencies, and other institutions; and (3) ASME technical papers not preprinted for meetings. Abstracts of ASME preprints will be found in the "ASME Technical Digest" section.

For the texts from which the abstracts of the "Briefing the Record" section are prepared, the reader is referred to the original sources; i.e. (1) The technical magazine mentioned in the abstract, which is on file in the Engineering Societies Library, 29 West 39th St., New York 18, N. Y., and other libraries. (2) The manufacturer, Government agency, or other institution referred to in the abstract. (3) The Engineering Societies Library for ASME papers not preprinted for meetings. Only the original manuscripts of these papers are available. Photostat copies may be purchased from the Library at usual rates, 40 cents per page.

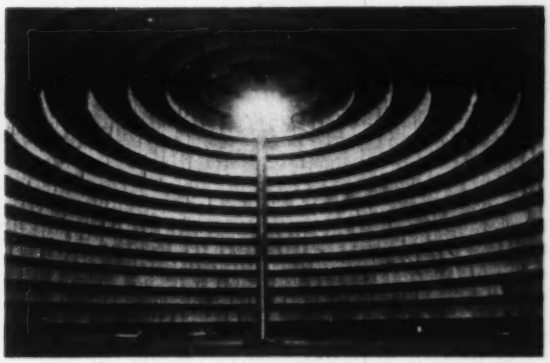
Engineering developments . . . at a glance



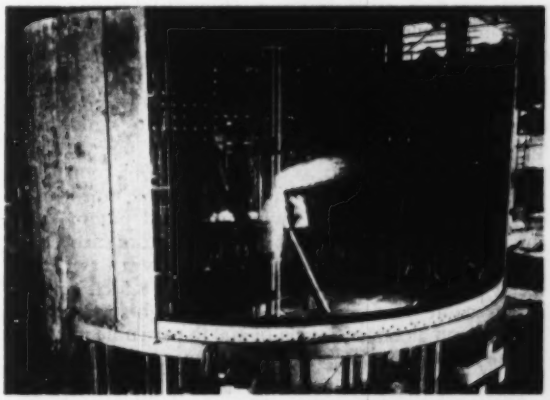
Acid-Resistant Clothes. Wearing acid-resistant clothes and an industrial gas mask, this New York University Engineering Research Division aide transfers chemicals to a vacuum system for filling Geiger counters. The special clothing, called "ChemKlos," and the breathing protection are developments of the Mine Safety Appliances Company, Pittsburgh, Pa. These safety measures are needed in handling the variety of chemicals and gases employed in an investigation of the fundamental processes of Geiger and neutron counters at New York University.

Corrosion-Resistant Coating. Highly corrosive cooling water did not attack National Radiator Company cooling sections treated with a new coating material, Kolmetal, *left*, which remained clean and bright after two years of service, but put inch-thick deposits on uncoated castings, *right*, which resist corrosion in most cooling waters. The coating is a mixture of finely pulverized aluminum powder in a special plastic vehicle. The metallic particles comprise about 85 per cent by volume of the mixture. The plastic base completely seals the metal particles to make a tightly bonded, flexible, and adherent coating. The new coating was developed by Emjay Maintenance Engineers, Rutherford, N. J. Properly applied, the coating can be polished, ground, drilled, or bent to a 45-deg angle without chipping, peeling, or cracking. Coated sections can be handled the same way as untreated sections.

Convertiplane. A completely new concept of flight is embodied in the XV-1 Convertiplane, an aircraft equipped with a rotor for vertical flight and wings and propeller for forward flight. Using the "unloaded rotor principle," the Convertiplane is the first military aircraft fo this type ever developed in the United States. The aircraft is a joint development of the Air Force's Air Research and Development Command, the Transportation Corps of the U. S. Army, and McDonnell Aircraft Corporation. In vertical flight or hovering the rotor provides all the lift; in forward flight the wings provide essentially all the lift. Each of the three blades of the rotor is powered by a pressure-jet unit located at the tip of the blade. A Continental reciprocating engine is provided on the aft fuselage to supply air to the pressure-jet units during vertical flight and power to the propeller during forward flight. The wings are approximately half the size of the wings for conventional fixed-wing aircraft. The Convertiplane is designed to carry three passengers or two litter patients and medical attendant in addition to the pilot. The aircraft is approximately 30 ft long, 10 ft high, and spans 26 ft in width. The crew compartment is equipped with large plastic windows which provide a wide range of vision.

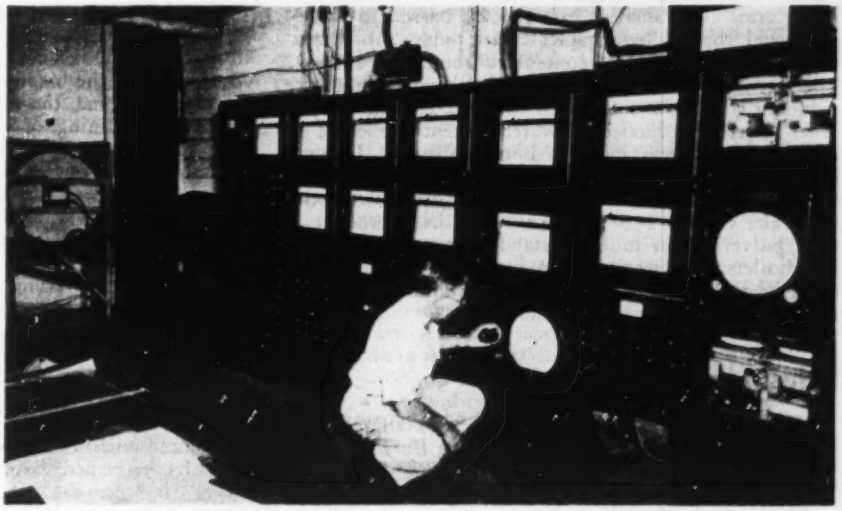


Semisphere Building. Outdoor and indoor views of a huge new giant dome-shaped building just completed at Longview, Texas, which can seat up to 12,000 people at a time. The structure, known as the Semisphere Building, is 85 ft high, 300 ft in diam, and covers 70,686 sq ft of floor area. The building is a product of R. G. LeTourneau, Inc., of Longview. The cone-shaped hood at the peak of the dome in the outdoor picture controls the ventilation of the building. In the inside view the relative sizes of the automobiles and their drivers give some idea of the vast amount of unobstructed interior space. Concentric rings of acoustical material have been suspended from the ceiling of the dome for sound control. The center pole is used for erection of the building. No interior structural supports are necessary in the completed building. Shown near the top of the center pole is a lighting installation of 75,000 watts. Assembly of the aluminum-and-steel building is a case of building from the top down. The structure is being considered for entertainment, religious gatherings, indoor sports, assembly-line operations, warehouses, and aircraft hangars.



240-Ton Tunnel Shield. Shown at *right* is a workman grinding a support on the tunnel shield fabricated by the American Locomotive Company for the third tube of the New York-New Jersey Lincoln Tunnel under the Hudson River. The shield will be a key piece of equipment in building the new tunnel as it will constitute the actual cutting edge used to thrust the tube through the bed of the river. As sections of mud and rock are removed from in front of the shield, it is thrust through the muck under tremendous hydraulic pressure and the cast-iron and cast-steel rings which form the lining of the tube are erected in the tail of the shield. Recently completed, the tunnel shield measures 31 ft 8 in. in diam × 18 ft 4 in. in length, and weighs some 240 tons.

Rocket Research Laboratory. Shown at *right* is M. J. Zucrow, Mem. ASME, calibrating a pressure gage prior to a test run in a $100,000 rocket research laboratory recently completed on the campus of Purdue University, Lafayette, Ind. Dr. Zucrow is the director of the new laboratory, the latest addition to extensive rocket and jet-propulsion research facilities at Purdue. The new facilities were specially designed for instruction in basic research activities and will be used in the investigation of such problems as the combustion characteristics of rocket fuel, motor cooling, and rocket combustion. Built-in features of the laboratory include an array of measuring and recording instruments, which facilitate gathering and correlation of the vast amount of technical data uncovered daily. During studies of ignition delay in fuel mixtures, for example, electronic instruments developed by the Industrial Division of Minneapolis-Honeywell Regulator Company automatically chart performance records of fuels being investigated. Subsequent analysis of these records helps improve mixtures so that fuels with the best combustion characteristics can be developed. The new laboratory is housed in two concrete and steel one-story buildings.



European Survey

Engineering Progress in the British Isles and Western Europe

J. Foster Petree,[1] Mem. ASME, European Correspondent

Colliery Tailings Pumped to Boiler Plant

THE transport, preparation, and utilization of colliery tailings as the fuel for the Emile Huchet power plant in the Lorraine coal field, France, was the subject of a paper by Prof. R. Gibrat and F. Chenin, delivered on February 24 before the British Section of the Société des Ingénieurs Civils de France and the Supply Section of the Institution of Electrical Engineers. The interesting feature of the plant is that it burns washery sludge, which is pumped to the station through a pipe line 14.8 in. bore and 5.7 miles long. The sludge particles range up to 0.1 in. in diam, with a large proportion finer than 20 mils. The ash content is from 25 to 30 per cent and the water content, after draining, about 30 per cent. The mixture as pumped contains 300 to 400 lb of dry product per cubic yard. The design of the plant was based on experiments undertaken at the Neyrpic Hydraulic Laboratory at Grenoble. There are five electrically driven centrifugal pumps for transporting the sludge. One unit can be driven, by two motors, one of 400 hp and the other of 135 hp, at either 1450 or 965 rpm. Each of the other four units is driven by a single motor of 400 hp at 1450 rpm. With two high-speed pumps in use the delivery is 7 cfs with a maximum concentration of 200 lb of dry product per cubic yard; with two high-speed pumps and one low-speed pump, 8.8 cfs and 350 lb per cubic yard; and with three high-speed pumps, 10.9 cfs and a concentration of 400 lb per cubic yard.

The mixture is discharged into a pit, whence it is delivered onto vibrating screens which separate the tailings into particles of less than 24 mils and those of larger size. The smaller particles are passed to thickeners and thence, by compressed-air pumps, to filters, which reduce the water content to about 25 per cent. The larger particles are centrifuged in hydroextractors, reducing the water content to between 10 and 15 per cent. Further reduction of water content is effected in two Modave dryers and two Buttner dryers. In both types the sludge is introduced at the top and flows downward against an up-current of hot flue gases. At exit, the water content is 8 per cent. The dried product is then pulverized in mills of standard type. There are four boilers, each normally producing 270,000 lb per hr of steam at 1600 psi and 90 F. Three suffice for the normal load, the fourth being a stand-by.

Industrial Gas-Turbines

THE Swiss firm of Brown, Boveri and Company have now built 12 industrial gas-turbine sets, in addition to two gas-turbine locomotives. Operating experience with some of these sets was described by E. A. Kerez, of the Swiss Federal Institute of Technology, Zürich,

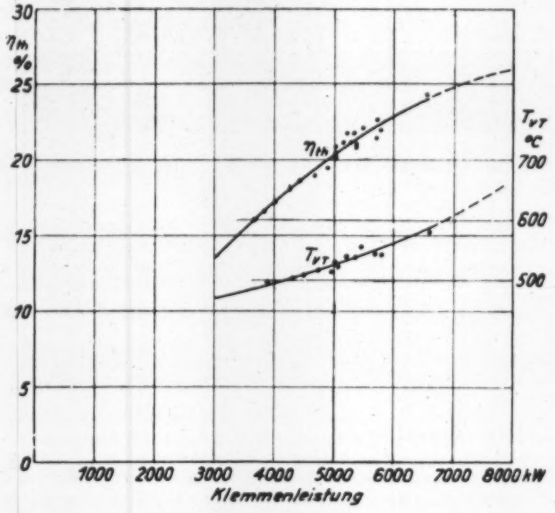


Fig. 1 Thermal efficiency and the inlet temperature to the gas turbine, at Dudelange, as a function of the terminal load

in a paper read on January 21 before the Diesel Engine Users' Association, London. They included one of 13,000 kw and another of 27,000 kw at Beznau power station, Switzerland, and a 5400-kw set, running on blast-furnace gas, at the steelworks of the Aciéries Réunies de Burbach-Esch-Dudelange, at Dudelange, Luxembourg. The last-named set went into service in April, 1951, and by Nov. 30, 1953, had run for 14,783 hr with an average load of 5363 kw. It was opened up for inspection only twice, in December, 1951, and at the end of 1952. No cleaning of the blades was necessary on either occasion in the turbine, the air compressor, or the gas compressor. The lining of the combustion chamber was stated to be "as new" and the tubes of the heaters were in similar condition. The blast-furnace gas used had a dust content of 3 to 4 milligrams per cubic meter and a calorific value of about 950 calories per cubic meter (106 Btu per cu ft). Fig. 1 shows the thermal efficiency obtained on test, as a function of the load and the temperature of the gas entering the turbine. The guaranteed output of 5400 kw and the guaranteed thermal efficiency of 21.5 per cent were realized with a gas temperature of only 550 C. At 600 C, the turbine has a maximum output of about 6800 kw and an efficiency of more than 24 per cent.

With the 27,000-kw Beznau turbine, some trouble was experienced with deposits of soot in the heat exchangers, which had to be fitted with compressed-air soot blowers, taking air from the high-pressure compressor at 100 psig. They are operated every 36 hr. When burning heavy residual oil, the Beznau turbines had to be shut down at intervals of 300 to 400 hr to remove slag from

[1] Correspondence with Mr. Petree should be addressed to 36 Mayfield Road, Sutton, Surrey, England.

the blading. The procedure was, first, to admit steam to the turbine from an electric boiler, to loosen the slag, and then to squirt in water under pressure, with the rotor turning, to wash the slag into the exhaust duct, from which it was carried away.

Diamond-Tool Production

So long as diamonds and other precious stones were used mainly for personal adornment, it was sufficient if the tools for grinding and polishing them could produce flat surfaces. Now, however, the most important uses are industrial, and for some of these—for example, the cones of Rockwell hardness testers—conical and spherical forms are required, with a surface finish equal to that obtainable on flat surfaces. The machine illustrated in Fig. 2 has been designed to grind accurately conical and spherical surfaces, double cones, and four-sided pyramids. The grinding-wheel carrier is mounted with its axis vertical and supports a 3-in. metal-bonded diamond cup-wheel, with a rim $^{3}/_{4}$ in. wide. It has a vertical fine adjustment and is motor-driven at about 4500 rpm. It rotates in an eccentric sleeve which is driven by a separate motor at 20 to 30 rpm, giving the face of the grinding wheel an eccentric movement of $^{3}/_{16}$ in. radius in its own plane. The stone-holder is adjustable in relation to the grinding wheel and is caused to swing, for the generation of cones and spheres, by a third motor, having two armatures and driving through a speed-reducing gear. The automatic swinging movement is controlled by a three-pole mercury switch, suspended as a pendulum, the two outside poles being connected to the two alternative armature windings. The switch is reversed by two tripping fingers, mounted on the oscillating shaft of the stone-holder. The holder is carried on a cross slide so that it can be traversed over the surface of the wheel; this is to allow for the grain of the diamond that is being ground. It can also be moved axially along the two bars to which it is clamped. The machine has been designed by Mr. Paul Grodzinski, director of the diamond research department of Industrial Distributors (Sales), Limited, 32–34 Holborn Viaduct, London, E.C.1, England.

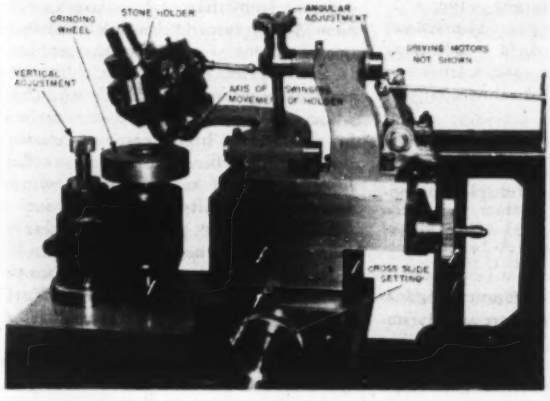


Fig. 2 Diamond-grinding machine for grinding conical and spherical surfaces, double cones, and four-sided pyramids

Distillation of Marine Boiler Feedwater

The new Peninsular and Oriental liner *Arcadia* is fitted with evaporating and distilling plant of somewhat novel arrangement and unusual capacity—550 tons of distilled water per day. This large capacity makes possible a big reduction in the amount of fresh water carried and enables an additional 1700 tons of deadweight cargo to be stowed. The system is the invention of S. A. Smith, the company's superintendent engineer.

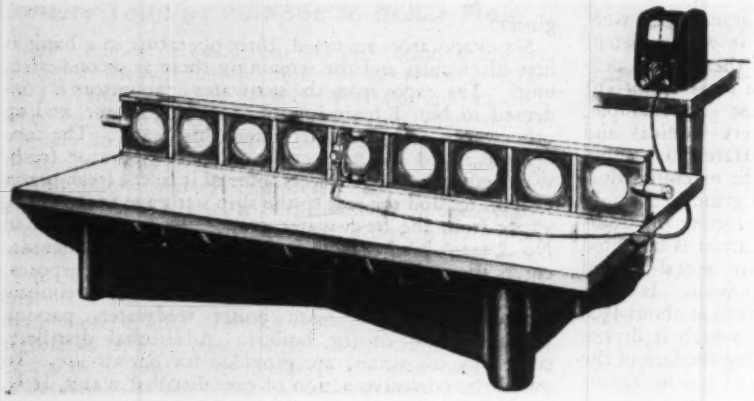
Six evaporators are fitted, three operating in a bank as first-effect units and the remaining three as second-effect units. The vapor from the sea-water evaporators is condensed in No. 1 main low-pressure feed heater, and no other vapor or drain water enters this heater. The condensate is led to the suction of the evaporator fresh-water pump, which delivers some of it to the fresh-water evaporator and the rest to the ship's storage tanks. The vapor from the fresh-water evaporator is condensed in No. 2 main low-pressure feed heater, and the condensate enters the main boiler feed system for make-up purposes. Thus the feed heaters serve as distillers, the cooling medium being the main boiler feedwater, passing through them to the boilers. Additional distillers, cooled by sea water, are provided for harbor use. To avoid the corrosive action of raw distilled water, it is, in effect, partly reconstituted by chlorination, filtration, and dechlorination when required for domestic purposes. The six salt-water evaporators have each a surface of 1050 sq ft. The fresh-water evaporator has a surface of 300 sq ft and a capacity of 75 tons a day. The distilled-water cooler and primary feed heater for the salt-water evaporators has a surface of 900 sq ft and the secondary feed heater, 1000 sq ft. The two distilling condensers are each capable of dealing with 150 tons of vapor per day.

New British Foundry Regulations

The Minister of Labour and National Service, in the British Government, is responsible for factory inspection. His department has now issued new regulations for the operation of foundries, cited as The Iron and Steel Foundries Regulations, 1953, which impose requirements (to quote the official text) "for the purpose of promoting safety and cleanliness in workrooms, and as to the provision and maintenance of protective equipment, bathing facilities, and clothing accommodation; and prescribe measures for the suppression of dust and fumes." The regulations regarding dust and fumes, baths and clothing accommodation do not come into operation until 1956, but the rest were effective from Jan. 1, 1954. They relate mainly to the width and surfacing of gangways, and the minimum distance at which a man may work from "a vertical line passing through the delivery end of any spout of a cupola or furnace . . . delivering molten metal . . . or the nearest part of any ladle which is in position at the end of such a spout . . ." Several of the regulations relating to dust and fumes, protective clothing, etc., merely give the force of law to practices which are already customary in well-managed foundries. The Chief Inspector of Factories is given authority to suspend the application of certain regulations to particular foundries, by certificate, if he is satisfied that, in these cases, their application is unnecessary, impracticable, or inappropriate.

ASME Technical Digest

Substance in Brief of Papers Presented at ASME Meetings



Indicating straight edge is shown in practical use to check a surface plate

Production Engineering

Testing Methods for Production of Accurate Machine Slideways, by G. N. Levesque, Mem. ASME, Brown & Sharpe Manufacturing Company, Providence, R. I. 1953 ASME Annual Meeting paper No. 53—A-69 (mimeographed; available to Oct. 1, 1954).

THE problem of making accurate machine slideways is intimately tied to that of making accurate straight edges and master planes. This paper deals with cast-iron machine ways and straight edges since to date cast iron has been the only suitable material where considerable length is involved.

In the production of large cast-iron straight edges, master planes, or machine ways, the normal way to accomplish the final finishing is to selectively work down the high areas as shown by frequent testing. This final work is usually done by hand-scraping.

A scraped surface may be considered flat only when a large number of points, spread fairly evenly over the surface, lie in the same plane. A familiar method of attaining flatness is that of scraping three surfaces so that any combination of two shows good bearing. The bearing test for flatness is very sensitive when the parts so tested are rigid. Errors in flatness of as little as 10 microinches can be detected. Unfortunately, adequate rigidity has been attainable only for small sizes of surface plates, say, up to about 12 × 12 in.

The errors left after careful bearing tests and corrections are those resulting from a slight curvature which extends over the entire surface. Determining the amount of this slight curvature has always been a difficult undertaking, especially where accuracy in the order of 0.0001 in. is required. Comparative tests can be made by means of an alignment comparator. A single surface can be explored with such a device or two separate surfaces can be compared. Accurate comparisons can be made by using a sensitive indicator. Four other methods for investigating slight curvatures are discussed as follows in the order of their increasing accuracy: (1) Use of the ordinary cast-iron straight edge; (2) autocollimating telescope; (3) precision level; (4) double-edged indicating straight edge. In each case, a length of 120 in. are considered to allow comparison.

Quality Control of a Multiple-Component Product, by C. D. Hunt, Remington Arms Company, Inc. 1953 ASME Annual Meeting paper No. 53—A-243 (mimeographed; available to Oct. 1, 1954).

IN THE firearms and ammunition industry, dimensional controls are vitally important. For example, an ordinary sporting cartridge for big-game hunting is composed of four principal parts, two of which may be classified as subassemblies. The parts are: (1) The bullet (usually a subassembly), (2) the shell or case, (3) the primer (a subassembly), and (4) the powder.

Furthermore, the assembled cartridge can be considered a part of the gun in which it is intended to be used. Modern firearms are also assembled from parts that must be produced under controlled conditions for proper functioning as well as safety.

The following important factors are involved in an economical control program:

1 Clearly established processes in a form readily available for use without misunderstanding or conflict.

2 Equipment which will do what the process specifies.

3 Good maintenance of equipment.

4 Machine studies for proof of adequate operation and controllability.

5 Sound but simple control procedures.

6 Gages designed to fit the whole job.

7 Training and performance to accompany the foregoing.

Air-Pollution Control

Air-Pollution Control in New York City, by Leonard Greenberg, Department of Air Pollution Control, New York, N. Y. 1953 ASME Annual Meeting paper No. 53—A-162 (mimeographed; available to Oct. 1, 1954).

THE air-pollution problems of different cities often are vastly different in character. New York City's problem is very different from that of Los Angeles. In New York, suspended solids constitute one of the major aspects of the problem. In Los Angeles, irritants of a chemically reactive nature are apparently the chief source of concern. New York is favored by a relatively high degree of scouring wind action, whereas Los Angeles suffers from a lack of such favorable winds. In Los Angeles little or no solid fuel is used for heating purposes, whereas in New York City the opposite is true.

In 1949, the first act was passed for the control of smoke pollution in New York, and in that year, rules and regulations were drafted. In 1950, the organization of the work of Smoke Control actually got under way as a bureau of the Department of Housing and Buildings. But this did not function to the satisfaction

of those interested in the whole over-all problem of air-pollution control, and pressure for wider coverage became insistent for the enactment of a law with wider coverage. In the year 1952, such a law was enacted and in November of 1952, the new Department of Air Pollution Control began its operations.

Sources of New York's air pollution include public and municipal utilities, incinerators, industries, and motor vehicles. In New York there are several companies engaged in the production and sale of gas, electricity, and steam, the largest of which consumes the equivalent of 9 million tons of bituminous coal each year. In its three power plants the city consumes 760,000 long tons of coal, more than 10 million gal of fuel oil, and over $1\frac{1}{2}$ billion cu ft of natural gas. A large portion of the boiler equipment in these city-owned plants is old. Much of the city's plants requires replacement and some progress is being made in this direction.

There are approximately 141,000 multiple dwellings in the city, practically all of which have their own boiler plants for heating purposes. At present there are 9000 flue-fed incinerators in multiple-family dwellings. Until recently, these incinerators were built without regard to proper combustion or to the control of the products of combustion. In operation they produce smoke, odors, and large amounts of fly ash. In an effort to control this pollution, the Board of Air Pollution Control has just proposed rules requiring that all incinerators be provided with roof settling chambers on or before Jan. 1, 1955.

Passenger-automobile gasoline consumption in New York City for the year 1952 was estimated at 1.1 billion gal, and for auto buses some 20 million gal of diesel fuel and gasoline were consumed. The end products of the combustion of this tremendous volume of gasoline represents a potential source of pollution of a great magnitude.

In the operation of a Department of Air Pollution Control, one must be governed by the amount of the funds provided for the task at hand. In any old city such as New York, a host of problems awaits the attention of the agency. One cannot move on all of these at one time, the backlog is just too great. Every effort must be made to develop the mass attack. Then again, new equipment is being installed day after day in factories, workshops, and in the form of fuel-burning appliances, and the like. By arranging for an installation licensing system, new installations may be controlled, so that they do not constitute potential sources of pollution.

The problem of existing installations presents greater difficulty. The policy here must be based on the granting of a reasonable period of time for compliance. If, for example, the cause of violation is purely one of operation, compliance should be immediate. However, if extensive changes must be made in the equipment, for example, the provision of a new boiler or the addition of an electrostatic dust-control device, then a longer period of time should be provided.

Air-Pollution Control in Los Angeles, by Paul L. Magill and Fred E. Littman, Stanford Research Institute, Stanford, Calif. 1953 ASME Annual Meeting paper No. **53—A-163** (mimeographed; available to Oct. 1, 1954).

THE persistent air pollution in Los Angeles causes damage to crops, reduces visibility, irritates people's eyes, cracks rubber, and has a characteristic odor. The populace calls it smog. This type of air pollution has been increasing over a period of years and has now become a serious nuisance. The atmospheric impurities that cause smog comprise a large number of gaseous and particulate substances, many of which are formed by reactions in the atmosphere between less noxious materials. The principal sources of impurities are all types of combustion operations and evaporation of hydrocarbons. Automobile exhausts are major contributors to the pollution. Many remedial efforts have been made but smog is still severe.

Some of the more important conclusions reached through chemical analyses of the atmosphere, characterization of its particulate matter, examination of materials as potential eye irritants, and fumigation of growing plants with various mixtures, are as follows:

Air contaminants are not predominantly any one type of material. They comprise a vast mixture of impurities, producing various unpleasant and damaging effects.

The principal nuisance effects of smog are believed to be caused by materials that are formed by reactions in the atmosphere.

The concentration of the oxidizing agent in the atmosphere is a good measure of the intensity of smog. Crop damage begins to occur at about 15 pphm, and eye irritation at about 20 pphm; higher concentrations are accompanied by numerous complaints and severe damage.

The oxidizing agent begins to form simultaneously throughout the entire Los Angeles Basin, at desert locations, and at points as far north as Santa Barbara. It usually reaches its peak intensity between noon and 2 p.m. Depending upon the impurities in the atmosphere, it may be more intense in one location than in another. These pockets of variable density give the illusion of smog always having been generated near the seacoast and blown in over the city, because when the sea breeze begins to blow inland, as it does daily, the more intense smog clouds, wherever formed, are carried to locations where smog is less intense. This helps explain why the heavy industrial area toward the ocean has erroneously been believed by some to be the sole source of atmospheric impurities.

When eye irritation is severe in Los Angeles, as many as 80 per cent of the people on the streets are affected. The irritation does not seem to be caused by any single substance, but a mixture of the gaseous materials found in the city's atmosphere will cause eye irritation if people are exposed to it under laboratory conditions. The large particulate matter in the atmosphere does not seem to be a factor.

Cities in northern California have the same type of crop damage as that observed in Los Angeles. Similar types of crop damage have been observed in England. Eye irritation is experienced in 23 per cent of the cities in the United States having a population of over 100,000. Poor visibility due to smoke and haze is frequently noticed in large American cities. However, in Los Angeles severe air pollution occurs more frequently than elsewhere, because of poor natural ventilation by the wind.

By most standards Los Angeles is a clean city since there is little soot or dustfall.

At least 50 different substances have been identified as impurities in the atmosphere. Compared with that found in other cities, the concentration of sulphur dioxide in the Los Angeles atmosphere is low, ranging from 0 to 0.1 ppm even during periods of severe smog, except in the areas adjacent to some industrial sources. Ozone is the one material, thus far discovered, whose concentration closely follows the subjectively evaluated intensity of the air pollution.

The reduction of visibility is caused by a variety of solid and liquid particulate materials in the atmosphere. Of these, liquid droplets appear to be predominant contributors to the haze. Some of these droplets may be formed by reactions in the atmosphere, many of them are liberated directly from sources of combustion. Other materials present are carbon, tar, metal particles, and crystals.

The crop-damage area extends north to Ventura, south to San Diego, a dis-

tance of 180 miles, and east to Riverside, 80 miles. The principal crop-damaging agents are believed to be the reaction products of unsaturated hydrocarbons and ozone. Ozone is occasionally present at concentrations large enough to cause crop damage by itself. Crops fumigated in greenhouses with the reaction products of ozone and hydrocarbons have many, but not all, of the symptoms observed in the fields following smog attacks, which suggests that not all of the crop-damaging agents have been discovered.

Plants grown in greenhouses which are open to free circulation of the outside atmosphere suffer the same damage as similar plants grown in the open field. The plants in the greenhouses may be protected from smog damage by cleaning the air. This is done by passing it through either activated carbon filters or shredded foam rubber.

In the five years that Los Angeles County has devoted to improvement of atmospheric conditions, there have been an estimated 600 tons per day of known pollutants eliminated. The County no longer has 55 commercial and municipal open dumps burning without any control. The 34 iron foundries in the County have been rigidly controlled. The major railroads serving Los Angeles have substituted diesel-electric engines for hundreds of coal locomotives. There is less sulphur in the air now than in the early 1930's. In spite of this, the fall of 1953 has had some of the most severe smog that the residents remember. Within the next two years, about $4,000,000 will be spent on remedial measures, including floating roofs or vapor-recovery systems on the large petroleum-products storage tanks throughout the area.

Meanwhile population is being added to Los Angeles County at the rate of 400 people per day. Industry is continuing to move westward. New refinery installations scheduled for completion in 1954 in the Los Angeles area will boost the daily crude-oil charging capacity by 220,000 barrels per day.

The fact that industry and population are expanding and smog is still severe, in spite of the many control measures adopted, strongly suggests that some new types of control will be required before air pollution is abated to a tolerable level.

The obvious sources that require new controls—both of which are under active consideration—are the backyard incinerators and the automobile exhausts. These are the tough ones, both politically and technically. Perhaps the political difficulties would disappear if there were inexpensive technical solutions. Improved methods of combustion for trash and gasoline present a real challenge to scientists and engineers.

Air-Pollution Control in Canada, by E. A. Allcut, Mem. ASME, University of Toronto, Toronto, Can. 1953 ASME Annual Meeting paper No. 53—A-138 (mimeographed; available to Oct. 1, 1954).

CANADA is a sparsely populated country and, therefore, the problem of atmospheric pollution has not yet become serious, save in certain industrialized areas, most of which are situated near the United States border. Most of the early attempts at control took the form of smoke-abatement ordinances or of clauses in a local building or other bylaw. These were general in form and, in most instances, did not contain any definite provisions for measurement or enforcement.

Subsequently, attention was drawn to pollution by sulphur dioxide and this culminated in an investigation made by the International Joint Commission, the assessment of damages, and the adoption of remedial works by the company concerned. Similar conditions now exist elsewhere, although to a smaller extent. The rapid and extensive industrialization of Canada, the greater prevalence of metallurgical and chemical plants, and the danger from radioactive materials has directed increasing attention to the broader aspects of the problem. These factors largely account for the considerable number of investigations made and papers published since 1930, and the more elaborate and specific bylaws which have been adopted by the larger cities since the end of World War II.

Most Canadian bylaws prescribe smoke indicators, or some means whereby the operator can see the top of the stack, and require installation and operating permits. Suppliers of combustion equipment also are directed to report all sales of such equipment, but in very few cases is there any limit to the volatile content of the coal that may be sold. The fees for permits vary in amount and in some instances they are scaled to suit variations in the size or capacity of the equipment. One or two corporations also specify annual inspections of combustion apparatus. In most cases, domestic installations are exempted from the provisions of the bylaw. Most of the ordinances contain general statements prohibiting the emission of odors and noxious gases, but no provision is made otherwise for their measurement or control.

In view of these variations, and envisaging the greater necessity of standardization with increasing industrialization, the Committee on Atmospheric Pollution in Canada was appointed in 1949, to study the situation and to draw up a skeleton code which would cover all types of pollution, a variety of possible sources of pollution, and differences that exist in the prevailing conditons across the Dominion. It is recognized that, in many instances, control measures have been deferred because of the absence of recognized standards and because enforcement in the smaller cities would be too expensive. The Committee recognized the fact that pollution is a regional and not a municipal problem and reported in favor of setting up pollution-control areas under the jurisdiction of the provinces. They also considered that the crux of the problem is the amount of pollutant emitted and not its density in stacks of different sizes. Recommendations were made regarding the organization and powers of the controlling body, with provision for variations to suit different local conditions. There still remains, however, the necessity of a greater degree of standardization and instrumentation in methods of measurement, so that results obtained in one area may be comparable with those in other areas.

In 1925, complaints were received of damage to farm and forest lands in northern Stevens County, Wash., from sulphur dioxide originating in Trail, B. C., and traveling along the Columbia River valley. During the next five years the emission of SO_2 rose to 600–650 tons daily. Substantial damages were awarded by an international tribunal and the matter was investigated by the National Research Council of Canada 1929–1937. The SO_2 concentrations are now recorded continuously by Thomas autometers, and the mass rate of emission is controlled by regulating the operation of the roasting furnaces in accordance with the prevailing meteorological conditions. Current loss to the atmosphere is less than 9 per cent of the sulphur charged.

The emission of arsenic trioxide from the roasters at Yellowknife, N. W. Territory, has resulted in a somewhat unusual problem that is now being studied. The two mines concerned are three miles apart and the town of Yellowknife lies between them. Their two stacks emitted 12 tons per day of arsenic trioxide in submicron form and, as a result, twenty expensive cattle died, wild life was destroyed, and people sickened by arsenical poisoning. To meet this difficulty, one mine installed Cottrell precipitators and the dry dust was dumped into caverns in the permafrost zone. The other obtained permission to use wet

scrubbers from which the wet effluent was pumped into a nearby lake. This ultimately produced a water-pollution problem, as the arsenic spread from one lake to another and contaminated drinking water. A new roaster was installed, doubling the capacity and the loading of the Cottrell, and the environmental levels rose again. Measurements of arsenic content are now being made in the air, water, soil, and vegetation for the purpose of throwing more light on the allowable limits of contamination.

Another investigation undertaken by the International Joint Commission relates to the Detroit-Windsor area, which is the third largest manufacturing area in North America. (MECHANICAL ENGINEERING, August, 1953, p. 647.) Coal consumption amounts to about 16 million tons annually and it is estimated that about 430,000 tons of SO_2 are released by combustion. There are also other contaminants. From 1949 onward, records have been kept of meteorological data, smoke emissions from vessels, SO_2 concentrations, gaseous and particulate contaminants, and deposited matter (dustfall).

Smoke-emission problems also exist with regard to railroads and steamships.

The problem has been acute in the Detroit river, where about 28,000 passages are made in a season and thousands of smoke readings have been taken by the Ringelmann-chart method. These reveal that, as a result of improved boiler equipment, firing methods, and the use of overfire air jets, the percentage of the time of smoke observations from vessels, corresponding to No. 3 Ringelmann chart or darker, fell from 51 per cent in 1950 to about 35 per cent in 1951.

Heat Transfer

Radiation in Metals, by N. W. Snyder, University of California, Berkeley, Calif. 1953 ASME Annual Meeting paper No. 53—A-132 (mimeographed; available to Oct. 1, 1954; to be published in Trans. ASME).

THIS paper presents a résumé on the electromagnetic theory of radiation in metals.

Most solids can be classified according to their optical and electrical properties. The two main groups are metals and dielectrics. According to modern theories of solids, both metallic and dielectric solids are crystals. A substance such as glass which does not have a definite lattice structure is classified as a liquid of very high viscosity.

Metals are materials of high electrical and thermal conductivity. At the same time they have a low emissivity, a high reflectivity, and a high extinction coefficient for infrared radiation and are therefore opaque. For very long waves, i.e., in the far infrared, the optical behavior of metals is determined completely by their conductivity and they have no characteristic absorption lines in that region.

Dielectrics are materials of low electrical conductivity. They usually have a higher emissivity and lower reflectivity than metals. In most regions of the spectrum they also possess a smaller absorption coefficient and are therefore much more transparent than metals. They do have absorption lines in the infrared; near these lines they behave similarly to metals (i.e., they have a high reflectivity).

There are intermediate materials between metals and dielectrics. In particular, there are the semiconductors which have low conductivities at ordinary temperatures, but whose conductivity increases suddenly when the temperature is raised. This paper deals mainly with metals.

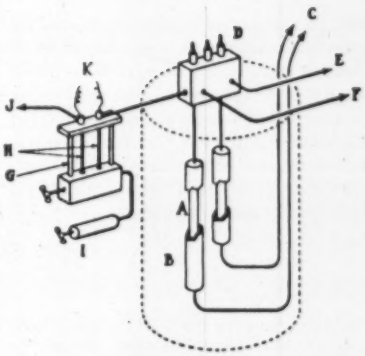
Compressibility of Gases—VIII, Krypton in the Temperature Range 0–600 C and Pressure Range 10–80 Atm, by E. Whalley and W. G. Schneider, National Research Laboratories, Ottawa, Can. 1953 ASME Annual Meeting paper No. 53—A-85 (mimeographed; available to Oct. 1, 1954; to be published in Trans. ASME).

A PROGRAM of measurement of the compressibility of a number of gases over a wide temperature range was undertaken several years ago. The main object of the measurements has been to obtain information on intermolecular forces.

Compressibility measurements for krypton together with an evaluation of the virial coefficients in the temperature range 0–600 C are described in this paper. It is planned to carry out similar measurements for the remaining inert gases, neon and xenon, and to examine binary mixtures of the inert gases to obtain information on the nature of the force field between unlike molecules.

The compressibility of krypton has been measured over the temperature range 0–600 C and pressure range 10–80 atm by the expansion method described by Burnett.

The gas to be measured is compressed into a large pipette to a pressure of about 80 atm either by condensation into a small pressure bomb and evaporation, or by a mercury piston. At the same time, the pressure is built up in the pressure vessel surrounding the pipette and thereafter the pressures inside and outside the pipette are kept balanced to within 1 atm. When temperature and pressure equilibrium are obtained, the pressure is recorded and the gas expanded into the second pipette. After the pressure is again measured, the expansion valve is closed and the gas in the small pipette is allowed to expand into a gasometer, or condensed. After evacuating the small pipette, the foregoing cycle is repeated. In this manner, about nine pressure ratios are obtained. The isotherm is then repeated starting at a lower initial pressure so as to stagger the points on the pressure ratio-pressure plot.



Gas pipette assembly. A, gas pipettes; B, pressure vessels surrounding gas pipettes; C, gas connections for B; D, expansion valve block; E, vacuum line; F, line to compressor and gas supply; G, mercury U-tube; H, glass capillaries; I, mercury injector; J, pressure-gage connection; K, electric-needle contact leads

Metals Engineering

Evaluation of Transient Temperatures and Stresses, by R. J. Fritz, Knolls Atomic Power Laboratory, General Electric Company, Schenectady, N. Y. 1953 ASME Annual Meeting paper No. 53—A-75 (mimeographed; available to Oct. 1, 1954, to be published in Trans. ASME).

THERE are several trends in modern power-plant design and practice that make a knowledge of transient temperatures and stresses important. Long-time start-ups of stationary power plants are costly. The use of liquid metals in heat exchangers and nuclear reactors increases thermal stresses because of inherently low film heat-transfer coefficients. In these components as well as in the gas turbine and other heat engines an accurate evaluation of thermal stresses and distortions must be made in order to insure safe and reliable operation. It then becomes important to be able to calculate accurately transient-temperature distributions and stresses in structural elements.

This paper presents a discussion of de-

sign factors, graphs, and other data on transient-temperature distribution and thermal stresses which have been found helpful in design evaluations. Solutions to the one-dimensional heat-conduction equation for arbitrary surface temperature transients are treated by superposition of other tabulated solutions and by a concept of thermal reflections.

An Apparatus for the Study of the Effects of Cyclic Thermal Stresses on Ductile Metals, by L. F. Coffin, Jr., Mem. ASME, and R. P. Wesley, Knolls Atomic Power Laboratory, General Electric Company, Schenectady, N. Y. 1953 ASME Annual Meeting paper No. 53—A-77 (mimeographed; available to Oct. 1, 1954; to be published in Trans. ASME).

In cases in which high rates of heat transfer exist, as in nuclear reactors, severe thermal stresses can be developed in structural metals. These stresses can be relieved by plastic flow and, consequently, are not regarded as serious when steady-state conditions prevail. Under the action of thermal oscillations, however, cyclic thermal stresses are developed. Depending on the frequency of thermal cycles and the severity of the thermal stress, fatigue failure can result. Because of its low thermal conductivity and high thermal expansion 18 per cent chromium–8 per cent nickel stainless steels are particularly prone to this effect.

An investigation of this problem has been under way for some time. The object has been twofold: (*a*) To obtain information so that a particular material may be assessed critically for its resistance to thermal stress-fatigue damage under specified conditions, and (*b*) to investigate the fundamental aspects of the problem in order to learn more about the fatigue phenomenon.

The paper describes the test apparatus developed for this study. A report in preparation gives the test results to date and their interpretation. Essentially, the apparatus subjects a tubular test specimen of a structural material to a one-dimensional constraint. By subjecting the specimen to cyclic temperatures, an alternating uniaxial stress is developed which will produce a fatigue failure in the specimen after a sufficient number of stress cycles. The device has considerable flexibility in adjustment of temperatures of cycling and frequency of oscillation. A control system permits the cycle to continue automatically to failure of the specimen. Modification of the apparatus permits the strain cycling of test specimens at constant temperature.

The apparatus has the advantage of subjecting materials to a simple stress system which can be measured directly. It is possible to separate out elastic and inelastic strains and to study the effect of strain hardening with cycling. Effects of prestraining and stress concentrations can be investigated readily.

Attention has been given to temperature distribution in the specimen; all other possible stresses which may arise are found to be secondary in effect. Randomness in fracture location substantiates this.

The essential feature of the apparatus is the imposition of a complete longitudinal constraint on the test specimen so that any longitudinal thermal deformation of the specimen is converted directly to elastic or inelastic deformation. To accomplish this, the apparatus is designed to clamp each end of the test specimen rigidly to end plates so that longitudinal play in the clamps is reduced to a negligible amount (<0.0005 in.) when the specimen load is completely reversed.

In addition, to prevent motion of the end plates relative to each other, the two plates are rigidly connected by heavy columns. The columns also serve as weighbars to give the instantaneous stress on the test specimen.

A Study of the Effects of Cyclic Thermal Stresses on a Ductile Metal, by L. F. Coffin, Jr., Mem. ASME, Knolls Atomic Power Laboratory, General Electric Company, Schenectady, N. Y. 1953 ASME Annual Meeting paper No. 53—A-76 (mimeographed; available to Oct. 1, 1954, to be published in Trans. ASME).

The results of a study of cyclic strain and fatigue failure arising from cyclic thermal stresses are reported. By means of a test apparatus described in a companion paper, a cyclic temperature is imposed on a thin tubular test specimen subjected to complete longitudinal constraint. Hence the cyclic strain is the independent variable.

The following studies are reported:

(*a*) Effect of thermal stress cycling on strain-hardening and life-to-failure for a fixed mean temperature, (*b*) effect of degree and kind of previous cold-work on strain hardening and cycles-to-failure, (*c*) effect of mean temperature on thermal stress cycling, (*d*) effect of period of cycle on cycles-to-failure, (*e*) effect of prior strain cycling on stress-strain characteristics, and (*f*) effect of stress concentrations on fatigue by cyclic thermal stresses.

The significance of factors such as hysteresis, Bauschinger effect, strain-hardening, strain aging, and fatigue-crack formation are discussed, and a mechanism is described to relate these factors.

Evidence is presented to show that strain-hardening is not an important factor in the problem. The concept of total plastic strain is discussed.

From the various measurements and observations made during the tests certain general conclusions can be drawn regarding the fatigue process:

1 The significance of cyclic plastic strain as the basic cause of fatigue failure is confirmed in all of the tests carried out in this study.

2 Strain-hardening of the initially annealed material during strain cycling is very small and tends to saturate. The amount of strain-hardening increases with increasing strain amplitude, but a saturation again occurs. Thus a fairly stable hysteresis loop is characteristic of the fatigue process.

3 Prior cold-working results in a strain-softening of the material which depends on the strain amplitude and amount of prior cold-work. The effect has been shown to be a result of strain cycling and not of annealing effect in the metal. The asymptotic nature of the effect with strain cycles excludes the possibility of structural deterioration as an explanation.

4 Prior cold-work acts to reduce the ductility available for fatigue so that under the same plastic strain amplitude the life of the material is actually less than that of annealed materials.

5 The kind of prior cold-work can alter the plane of fracture in fatigue. Severely twisted specimens exhibited a helical fracture when subjected to cyclic strain.

6 Reversed plastic strain has little effect on mechanical properties until a fatigue crack has occurred. The crack then acts as a stress raiser to decrease the fracture ductility.

7 A quantity defined as the total plastic strain can be calculated for each specimen tested. This strain is found to increase as the strain amplitude of the cycle decreases (or as the number of cycles-to-failure increases). A relationship between the total plastic strain and the cycles-to-failure is found to be linear when plotted on log-log co-ordinates. This line can be extrapolated for the present material to give a value which agrees with fracture ductility in simple tension. Other conditions being equal, the total plastic strain is reduced by prior cold-work.

Thermal-Shocking Austenitic Stainless Steels With Molten Metals, by R. A. Tidball and M. M. Shrut, Mines Safety Appliances Company, Callery, Pa. 1953 ASME Annual Meeting paper No. 53—A-179 (mimeographed; available to Oct. 1, 1954; to be published in Trans. ASME).

At the request of the Nuclear Power Division of the Bureau of Ships, Navy Department, a test program was arranged between Knolls Atomic Power Laboratory of the General Electric Company and the Mine Safety Appliances Company to subject a series of austenitic stainless-steel specimens of large size to thermal shock to determine its effect on welding techniques and procedure.

Specimens of AISI 347 pipe and pipe welds were subjected to repeated thermal shocks by quenching the inner surface with cool sodium-potassium alloy. The equipment used and a method of measuring the transient fluid and wall temperatures are described. Temperature changes encountered during tests and resulting stresses are shown. The effects of 2500 transient thermal cycles on one specimen are discussed.

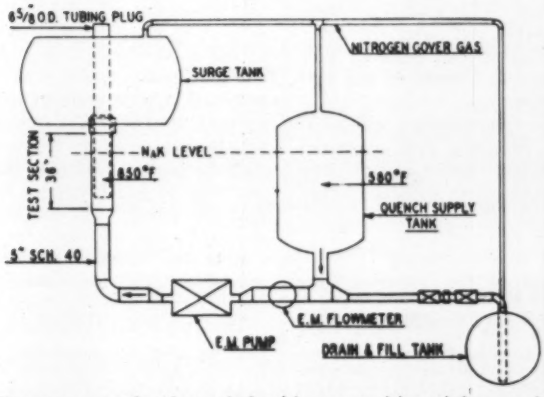
The apparatus consisted of three 350-gal tanks and electromagnetic pump, a magnetic flowmeter, a test section, and interconnecting pipe. The three tanks, each 3 ft in diam, 4 ft long, with dished heads, were fabricated from $^1/_4$-in-thick stainless-steel plates. One tank, holding the quench supply, was mounted vertically inside a furnace and heated by gas. The rate of firing was controlled by the temperature of the NaK in the tank. A second tank was employed as a surge tank to collect the NaK above the test section during the thermal-shock cycle. The third tank was an emergency drain tank which also held the NaK charge during shutdown periods.

The electromagnetic pump was a 500-gpm, 15-psi, a-c conduction-type pump built by the Mine Safety Appliances Company. The pumping section was a 36-in. piece of formed 3-in. schedule-40 AISI type 304 stainless steel. The magnetic flowmeter was calibrated in operation in the system.

A 6-ft length of $6^5/_8$-in-OD tubing was set inside the test specimen, extending through the surge tank, and capped on the lower end. This plug served to increase the NaK velocity inside the test section by decreasing the free-flow area.

The interconnecting piping was 5-in. schedule-40 stainless-steel pipe. The free surfaces of the NaK were protected by nitrogen gas. The nitrogen atmosphere was common to all tanks to equalize pressure during shocking and draining.

A typical test specimen consisted of three sections of 8-in. schedule-40 AISI type 347 piping connected by three girth welds. Rigid specifications on the welding procedures and testing were followed. Each pass was checked for flows using oil-penetrant tests and each weld was radiographed upon completion. A duplicate test section was fabricated which was examined for imperfections in the unshocked condition. Since microfissures are sometimes found at the joint of the backing ring, the parent metal and the weld metal, it was decided to fabricate test specimens as follows: Duplicate welds were used on each specimen. After the welding was completed one backing ring was removed prior to test and the area covered by the ring undercut 0.030 in. It was felt that this undercut would remove all root fissures and that any cracking observed after test would be due to thermal stresses without the added notch effect caused by the presence of the root fissures.



Test apparatus for thermal-shocking austenitic stainless steels with molten metals

Thermal Checking of Wrought-Steel Railway-Wheel Material, by H. R. Wetenkamp, University of Illinois, Urbana, Ill. 1953 ASME Annual Meeting paper No. 53—A-72 (mimeographed; available to Oct. 1, 1954; to be published in Trans. ASME).

The mechanism of the formation of small cracks (thermal checks) that are formed as a result of two heat cycles is discussed. These thermal checks were noted in the treads of car wheels. Careful examination of the conditions which caused them to form led to the development of a method of producing these thermal checks in a small specimen under better controlled conditions. The reasons for the checks forming more readily in higher plain-carbon steel are discussed. Basically, the contraction of martensite upon tempering seems to be the cause of the formation of thermal checks.

In the laboratory investigations conducted to study thermal checking in railway-car wheel steel, five compositions of steel were investigated. Tests were designed to: (*a*) Give a measure of check sensitivity of wheel steels; (*b*) study microscopically the area in which the check initiates; (*c*) determine the critical hardness range of the material in which the check initiated; (*d*) determine the amount of contraction of martensite upon tempering fully hardened specimens of wheel steel; and (*e*) determine the sign and magnitude of the residual stresses resulting from the test procedure.

The thermal-check sensitivity was found to increase with increase in carbon content within the range of carbon content considered. The results are in accord with the tests on full-size car wheels tested in the wheel-testing machine.

Hardness surveys showed that for a given class of steel the thermal checks initiated within a hardness range which was reasonably constant. As the carbon content of the steel was increased, there was a shift to progressively higher values of the limits of the hardness range, where checks initiated.

The data obtained from residual-stress determinations were qualitative in nature. The heat-affected zone of the specimens subjected to the initial hardening cycle were found to be under a compressive stress of 40,000 to 80,000 psi. Similar studies of specimens subjected to both cycles with conditions such that checking was impending, indicated tensile stresses ranging from 60,000 to 85,000 psi.

Determination of the contraction of martensite upon tempering resulted in data that were in good agreement with previous work. The theoretical maximum stress that could be caused by contraction of martensite was found to be of the order of 120,000 psi, assuming perfect restraint of the material and a biaxial

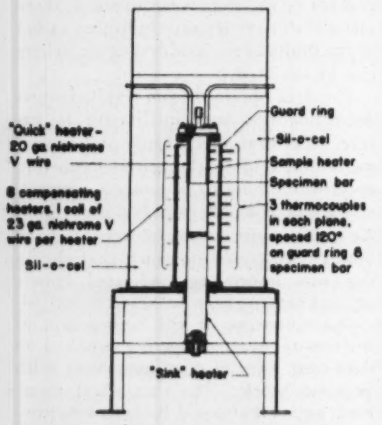
state of stress. This calculated value agrees reasonably well with the difference of residual stresses noted in hardened specimens and hardened and tempered specimens.

Microscopic examinations seemed to indicate that the checks were intergranular. The microstructure varied from tempered martensite to nodular pearlite.

Determination of the Thermal Conductivity of Molten Lithium, by H. A. Webber and R. C. Fellinger, Assoc. Mem. ASME, Iowa State College, Ames, Iowa, and David Goldstein, Sylvania Electric Products, Inc., Bayside, N. Y. 1953 ASME Annual Meeting paper No. 53—A-79 (mimeographed; available to Oct. 1, 1954; to be published in Trans. ASME).

THE properties of metals in the molten state must be known before heat-transfer relations can be computed in designing pumps, heat exchangers, valves, meters, and other equipment employing liquid metals. The objective of the present study was to design a reliable thermal-conductivity apparatus for molten metals at elevated temperatures and to measure values of the thermal conductivity of liquid lithium. The method used was the longitudinal heat-flow method with guard-ring compensation. An experimental determination of the thermal conductivity of liquid lithium was made by Yaggee and Untermeyer previously. They determined the relative thermal conductivities of lithium, sodium, and eutectic NaK at about 500 F. In their work no compensation was made for lateral heat losses, and the results were reported relative to the thermal conductivity of sodium.

In the present investigation conductivity coefficients for 99.8 per cent pure lithium were measured over the range 420 to 1002 F. Lithium showed a value of 26 and 18 Btu/hr sq ft deg F/ft at 420 F and 1002 F, respectively. Measurements based on an absolute heat input proved unreliable. The results were based on a temperature gradient measured in an Armco iron heat sink, the thermal conductivity of which appears in the published literature. The estimated error of the results was ±10 per cent.


"Quick" heater - 20 ga. nichrome V wire
8 compensating heaters, 1 coil of 23 ga. nichrome V wire per heater
Sil-o-cel
Guard ring
Sil-o-cel
Sample heater
Specimen bar
3 thermocouples in each plane, spaced 120° on guard ring & specimen bar
"Sink" heater

Cross section of assembled test apparatus for measuring thermal conductivity of liquid metals

Apparatus based on the use of a tall column of liquid for measuring thermal conductivities of liquid metals was used.

The sample was contained in an Armco iron specimen bar which had a 1.999-in. ID and a 2.126-in. OD. All Armco iron parts in contact with the air were nickel-plated to prevent atmospheric corrosion. The final outside diameter of the specimen bar, after nickel plating, was 2.135 in. and the entire length of the bar was approximately 22 in.

Preliminary Investigation on the Effect of Sequence on Cold-Drawing Cylindrical Steel Rods Through Dies, Part I, by Harry Majors, Jr., Mem. ASME, California Research & Development Company, Livermore, Calif. 1953 ASME Annual Meeting paper No. 53—A-73 (mimeographed; available to Oct. 1, 1954; to be published in Trans. ASME).

COLD work in controlled amounts may be imparted to steel by stressing in tension beyond the proportional limit, by direct compressing, drawing, rolling, swaging, and twisting. There is general agreement that all of these operations of deforming metal need not yield the same effect. Wire drawing produced a greater change than rolling for the same amount of reduction. These methods can produce different degrees of embrittlement. One possible sequence is to produce 1 per cent reduction followed by a light draft of, say, 0.3 per cent reduction of area to obtain favorable residual stresses.

This investigation is concerned with the effect of sequence in cold-drawing where successive true reductions are 7 per cent or larger between dies. It is Part 1 of three parts in which Part 2 discusses the effect of sequence on cold-drawing properties of 2S-O aluminum while Part 3 attempts to show the effect on the coefficient of friction. Various properties were obtained to discover which one was affected by sequence in drawing annealed SAE 1020 steel. True tensile properties, hardness, torsion properties, residual stresses, and microstructure were determined. Some exploratory work was conducted on the influence of cold-drawing and fatigue upon the brittle transition temperature. The influence of size of specimen, machining, and time after cold-drawing upon the tensile curves was determined.

In this preliminary work the effect of sequence in cold-drawing was investigated by means of true stress-strain tensile diagrams, torsion curves, residual stress measurements, and microstructure pictures. A series of hardened conical steel dies was used with half angles of about 1 deg in which the speed of drawing was 2 ipm. Successive true reductions were 0.07 in. per in. or larger. All rods were coated with a solution of Calgon which formed a powdered coating on drying. This surface was lubricated with a paste made from SAE 40 oil and type M Molykote powder.

The results of these experiments are as follows:

1 Yield strength (0.1 per cent offset) in tension is varied a maximum of about 5 per cent depending upon the sequence.

2 Sequence in drawing had no effect upon the true stress-strain diagrams in tension.

3 Sequence had no effect upon the average Vickers hardness number.

4 Preliminary tests indicate an effect of sequence on torsion tests when the rods are not machined, but the sluggishness of the torsion machine prevents the establishment of the magnitude. Torsion tests must be conducted on a more sensitive machine.

5 Sequence influences the magnitude of the surface residual stress. The "not reversed, by-passed" and "reversed, not by-passed" sequences produce lower surface stresses than the not reversed, not by-passed sequence.

6 An examination of the grain structures across the rod section did not reveal a significant change for the various sequences. No examination was made of the rod surface.

Effect of Sequence on Cold-Drawing 2S-O Aluminum Rods Through Dies, Part II, by Harry Majors, Jr., Mem. ASME, California Research & Development Company, Livermore, Calif. 1953 ASME Annual Meeting paper No. 53—A-74 (mimeographed; available to Oct. 1, 1954; to be published in Trans. ASME).

THIS paper is Part 2 of three parts in which Part 1 discussed the cold-drawing of annealed SAE 1020 steel while Part 3 attempts to show the effect of sequence on the coefficient of friction for steel and aluminum. Also, in Part 3, direct determinations of the coefficient of friction are reported. Various properties were obtained to learn which one was influenced by sequence in cold-drawing 2S-O aluminum rod (1 in. diam originally) through

various die sizes from 1 in. down to $^{11}/_{16}$ in. nominal diameter. True tensile stress-strain diagrams, hardness measurements, torsion properties, residual stresses, and microstructure were determined for the four sequences investigated. In addition, the average pulling loads are tabulated which will be used in Part 3 to determine the effect of sequence upon the average coefficient of friction.

The conclusions reached are as follows:

1 Sequence, as defined in this investigation, had a small effect on the yield strength. The maximum difference in values was about 4 per cent depending upon the sequence. For a true rod reduction of 0.760, sequence had very little effect. The same order of difference was observed for SAE 1020 steel.

2 There was no effect upon the true stress-strain diagrams for the four sequences investigated. A similar conclusion was reached for steel.

3 Sequence had no effect upon the average Vickers hardness number. A hardness traverse revealed a uniform hardness through the rod.

4 Shear stress-strain diagrams indicated that sequence influenced the yield strength in shear. The shear diagrams plotted to rupture were not influenced by sequence in cold-drawing.

5 Sequence in cold-drawing alters the distribution and magnitude of the residual stresses. Smallest tangential and longitudinal residual stresses on the rod surface were obtained from both "reversed" sequences.

The Effect of Dispersions on Creep Properties of Aluminum-Copper Alloys, by W. H. Giedt, O. G. Sherby, and J. E. Dorn, University of California, Berkeley, Calif. 1953 ASME Annual Meeting paper No. **53—A-78** (mimeographed; available to Oct. 1, 1954; to be published in Trans. ASME).

ALTHOUGH extensive investigations have already been conducted on biphase alloys, no definite conclusion has been reached on how the fineness of dispersions of intermetallic compounds in the alpha matrix affects their creep resistance. Several investigators found that the coarser dispersions exhibit superior creep resistance; and this prevailing conclusion is consistent with the widely postulated thesis that the most stable structure induces the greatest creep resistance. But the generalization that coarser dispersions always provide greater creep resistance should not be made without qualifications. First, the differences in the pretreatments that are used to develop the various dispersions might also alter other less readily detected structural factors. For example, when the fine and coarse dispersions are produced by the crude procedure of chill casting and sand casting, respectively, it cannot be clear whether the observed differences in creep behavior should be ascribed to the differences in the dispersion, differences in the grain sizes of the alpha solid-solution matrix, differences in residual stresses, or even differences in the strain-hardened state arising from plastic deformation resulting from thermal gradients that were introduced during cooling. Second, the creep properties at low temperatures and high strain rates parallel somewhat the tensile properties. In this range, therefore, the finer dispersions would be expected to exhibit superior creep resistance. And, third, a few observations at relatively high temperatures have shown that the finer dispersions are superior in creep resistance to coarser dispersions.

It is possible that the present state of knowledge regarding the effect of dispersions on creep is due to the fact that thus far only few tests have been made on isolated examples. No systematic study has been reported on the effects of dispersions on the creep resistance of biphase alloys. This investigation attempts a systematic study on the effects of dispersions of $CuAl_2$ on the creep behavior of high-purity Al-Cu alloys.

The creep properties of a system of 3 to 5 per cent Cu in Al alloys containing hard particles of $CuAl_2$ were investigated throughout a temperature range of 350 to 578 K. The results supplemented with additional tensile-test data show that these properties are primarily dependent on the volumetric mean free path of the $CuAl_2$ particles and independent of minor variations in composition and heat-treatment.

Education

Deliberate Creativeness in Engineering, by Maurice Nelles, Mem. ASME, Borg-Warner Central Research Laboratory, Bellwood, Ill. 1953 ASME Annual Meeting paper No. **53—A-171** (mimeographed; available to Oct. 1, 1954).

CREATIVENESS in engineering results in optimum design and maximum usefulness. An engineer's ability to be creative can be developed and with proper understanding of the principles involved, engineers can deliberately create new things and processes. Creativeness in engineering is one of the important keys to technical and sociological progress.

The attempt to deliberately create something implies that a goal has been set. Although goals are usually given to engineers, one of their first duties is to determine the extent of the goals and to determine what is really wanted. Unless the goalsetter has been acting creatively the goals may be undesirable in comparison to what could be achieved with the same or less expenditure of time and money. A check list for a valid goal may include the following: (*a*) Studies of data on needs; (*b*) what are the deficiencies of present entities; (*c*)

How to Order ASME Papers

COPIES of ASME technical papers digested this month are available until October 1, 1954, at 25¢ each to members; 50¢ to nonmembers.

Acceptable methods of payment are by check, U. S. postage stamps, **free coupons**[1] supplied to every ASME member, and purchased coupons—ten of which a member may buy for $2 and a nonmember for $4.

When ordering, please give paper number, its title, author's name, and quantity wanted; or use order form.

Orders should be addressed: ASME Order Department, 29 West 39th Street, New York 18, N. Y.

[1] **By the July 23, 1953, action of the Council, all ASME members are to receive ten free coupons annually which they may use to acquire technical papers presented at ASME meetings. The first sets of free coupons were mailed to members in August, 1953.**

NOTE: No digests are made of ASME papers published in full or condensed form in other sections of MECHANICAL ENGINEERING.

ASME publications and advance copies of ASME technical papers are on file in the Engineering Societies Library and are indexed by the Engineering Index, Inc., both at 29 West 39th Street, New York 18, N. Y.

ASME Transactions and the *Journal of Applied Mechanics* are on file in the main public libraries of large industrial cities and in the technical libraries of engineering colleges having ASME Student Branches.

ASME Order Department
29 W. 39th St., New York 18, N. Y.

Date .....

Please send me the papers indicated by the following circled numbers:

53—A-54	53—A-85
53—A-69	53—A-132
53—A-72	53—A-135
53—A-73	53—A-138
53—A-74	53—A-162
53—A-75	53—A-163
53—A-76	53—A-171
53—A-77	53—A-172
53—A-78	53—A-179
53—A-79	53—A-217

53—A-243

Name .....

Address .....

☐ Remittance enclosed ☐ Bill me

☐ ASME Mem. ☐ Nonmem.

are substitutes better; and (*d*) imitate and improve.

After goals are studied and thoroughly understood the next step in deliberate creativeness is to organize ways to achieve the goals. In engineering, there are several well-tried ways that can be used to achieve goals. Some of the steps may be as follows: (*a*) Make preliminary designs; (*b*) make models; (*c*) make laboratory experiments; (*d*) read in one's own field of special interest; (*e*) talk over the problem with others; (*f*) try opposites; and (*g*) try limits.

Instruction in Creative Mechanical Design, by George B. Du Bois, Cornell University, Ithaca, N. Y. 1953 ASME Annual Meeting paper No. 53—A-172 (mimeographed; available to Oct. 1, 1954).

METHODS of instruction in ingenuity are outlined briefly for an elective course in creative design for mechanical-engineering students. Practice on ingenuity problems reduces the fear of unfamiliar situations, and considerable initial gain appears possible. The mechanism of ingenuity is analyzed and compared to the memory process. The problem is to approach a mental gap close enough by practical work so that the mind can see across.

Ingenuity problems are divided into two classes. For those where an improved solution is needed a number of transition methods are outlined. For those where a solution is lacking, several initial solution methods are suggested. For an elective course in mechanical design based on the fundamentals and productibility, the ingenuity element adds interest, increases design experience, allows three or more solutions to be required, and has an inspirational value leading to a more advanced mental attitude. Most problems do not require genius, just a little actual work with a pencil.

Simplified Drafting Practice—College Viewpoint, by Ralph S. Paffenbarger, Mem. ASME, Ohio State University, Columbus, Ohio. 1953 ASME Annual Meeting paper No. 53—A-135 (mimeographed; available to Oct. 1, 1954).

THIS paper discusses the training concepts, including simplified drafting practices, in the planning and presentation of engineering drawing courses.

Simplified practice has continually been one of the principle incorporations in our methods of drawing instruction and coverage over the years. Of early concern, in the basic course, is the teaching of shape description. Freehand sketching is done for many periods before drawing instruments are introduced. This has more than one objective. It develops early in the course not only the student's sketching technique as a means of quick expression, but also permits greater coverage with more problems, thus giving the student a broader background in the same amount of time. It likewise acquaints the student with a simplified practice which under certain conditions may be substituted for instrument drawings.

Only a limited time is spent on pure lettering practice. In the early stages of training, however, a portion of the student's grade is based upon this work since careless performance might have a detrimental effect in achieving the over-all goal of clarity.

Inking techniques have long been deemphasized. There are those who feel that inking should be completely eliminated from our courses. Most certainly it should be minimized. However, inking is essential with many types of charts, graphs, and other illustrations, and with drawings for reproduction where a considerable range in line weights and sharp contrasts are necessary. Good figures and illustrations are just as important in a technical report as good English.

Basic courses stress the American Standard Drafting Practices wherever applicable. This includes all conventional representations as well as the principles of projection and standards of delineation. Much of the specialized material is left for the more advanced courses of design in the various branches of engineering.

The development of skill, in both freehand sketching and the use of instruments, is an important objective throughout all phases of the presentation. However, time is not spent on profitless, routine, and repetitive assignments. In order to create and hold the student's interest, problems deal with actual objects in so far as possible. The student is shown, early in his development, that the graphic language has a wide and important application. He is trained to develop habits of accuracy and made to understand that engineering practice does not tolerate mistakes that may involve life in addition to dollars.

Teaching aides are an excellent help in this training program. Much progress has been made in the preparation of audiovisual materials.

Examinations are designed to serve not only as a means of evaluating the student's performance, but also have other important educational objectives. They are usually comprehensive in nature, validated, and stimulative to the student. Both performance and objective types are used and are presented at frequent intervals. For course grades more emphasis is placed upon the results of testing than upon laboratory performance because, with tests the student is completely on his own and has to think for himself.

Hydraulics

Silencers for Compressors, by R. B. Bourne, Maxim Silencer Company, Hartford, Conn. 1953 ASME Annual Meeting paper No. 53—A-54 (mimeographed; available to Oct. 1, 1954).

SATISFACTORY silencers have long been available for any kind of compressor. The type of silencer used depends upon the type of compressor and also upon the piping layout. In general, silencers should be installed as close to the compressor as possible so as to avoid resonance conditions at the low frequencies and to anticipate the possibility of noise radiating from the connecting piping.

All silencing of pipe-borne noises is accomplished by converting the energy in the vibration to heat, by preventing the creation of the sound in the first place, or by utilizing directive efforts whereby the sound is projected away from regions where it can cause trouble.

A typical silencer suitable for use on reciprocating compressors, positive-pressure blowers, and the like, comprises two cylindrical tanks in series connected by desonated conduits. The first tank or chamber has a slotted entrance conduit and the second chamber is fitted with a slotted discharge pipe leading to the tail pipe. The silencer works because it provides a generally nonresonant system for the audible frequency range, allows surges of gas to expand and be smoothed out, and attenuates high frequencies through multiple reflections within the differently sized chambers. The shell casing of the silencer is laminated to prevent tank noise. No acoustically dissipative material is used.

Where a considerable portion of the acoustic energy is in the form of high frequencies, as is the case with certain high-speed centrifugal compressors, acoustically dissipative material of one form or another is used depending upon the nature of the gas and its temperature. Such materials range from ordinary hair felt to Inconel wool. A duct lined with sound-absorbing material converts sound energy directly into heat through losses incurred in the narrow interstices and

in the inelastic bending of the fibers.

In the case of heavy low-frequency pulsations, carefully designed traps are used to offer high attenuation to predetermined frequencies. There are, in general, two types of traps used. One type is in the nature of a "linear" resonator, an example of which is the "closed" organ pipe. Such a pipe, which may be made concentric with the main channel and, therefore, of greater cross-sectional area, offers high attenuation to sound frequencies for which it is any odd number of quarter wavelengths long. Two such traps, one half as long as the other, will attenuate the fundamental and several harmonics thereof.

Another trap is of the "volumetric" kind. This comprises a rather large closed tank surrounding the main channel and is acoustically coupled to it through a carefully designed opening.

The operation is the same for both types, but the volumetric type has considerably broader response for the fundamental frequency.

Management

Problems of Administration and Supervision in the Automatic Factory, by G. H Gustat, Eastman Kodak Company, Rochester, N. Y. 1953 ASME Annual Meeting paper No. **53—A-217** (mimeographed; available to Oct. 1, 1954).

INDUSTRIAL progress requires that automatic machinery must be utilized to an increasingly greater extent. The selection of personnel, training, quality of supervision, maintenance of equipment, and management problems inherent in such developments require solution. This paper outlines these and other aspects of adopting the automatic factory.

The paper states that the lower costs and greater production volumes will depend on how good and timely the judgment is that fosters the changes to automation.

There will be even greater need for technically trained personnel which is already a problem of considerable magnitude.

It will be necessary to incorporate better maintenance features into our designs because maintenance costs are usually very high in the automatic operations.

Selection of help must improve to fit people to this type of work.

Training programs on everything from economics to electronics must be improved so that operators have better understanding of their jobs.

The basic human urges for physical accomplishments must be provided for people on automatic operations.

Supervision must be better, both technically and in basic human understanding, to make these things work effectively.

Availability List of Unpublished ASME Papers

A NUMBER of papers and reports were presented at ASME Meetings which were not preprinted nor published. Manuscript copies of these papers are on file for reference purposes in the Engineering Societies Library, 29 West 39th St., New York 18, N. Y. Photostatic copies of these unpublished papers may be secured from the Library at the rate of 40 cents per page. The following papers recently have been placed on file in the Engineering Societies Library:

1953 ASME Semi-Annual Meeting

A Critique of the Statistics of Time Study, by R. T. Nelson and H. P. Edmundson

Physical Control as Applied to Production Control, by J. M. Druliner

The Momentum Principle Measures Mass Rate of Flow, by V. A. Orlando and F. B. Jennings

Development of an Automatic Data Plotter, by J. H. Weaver

One-Dimensional Velocity of a Burning Droplet, by C. C. Miesse

Experimental Investigation of Heat Transfer at Hypersonic Mach Numbers, by R. D. DeLauer and H. T. Nagamatsu

The Formation of Bubbles at Simple Orifices, by R. R. Hughes, A. E. Handlos, H. D. Evans, and R. L. Maycock

A Study of Shock Wave Turbulent Boundary-Layer Interaction, by Seymour M. Bogdonoff

Looking Ahead in Engineering Education, by L. M. K. Boelter

An Approach to the Sizing of Vapor-Relieving Systems, by Joseph Conison

The Statistical Trends in Air Safety, by Ben W. Ashmead

Value Analysis—A Plant-Wide Creative Cost-Reduction Program Under Purchase Leadership, by L. D. Miles

Free Convection in Electric Fields, by K. H. Weber and G. H. Halsey

Temperature Measurements in the Wake of Bodies in Supersonic Flow, by A. H. Lange

A Computational Technique for the Scheduling Problem, by Melvin E. Salveson

Permanent Management-Labor Peace and Full Employment, by E. Favary

Industrial Relations Training That Works, by C. H. Shumaker

ASME Transactions for March, 1954

THE March, 1954, issue of the Transactions of the ASME, which is the *Journal of Applied Mechanics* (available at $1 per copy to ASME members; $1.50 to nonmembers) contains the following:

TECHNICAL PAPERS

Laminar Swirling Pipe Flow, by L. Talbot. (53—APM-24)

Quasi-Static Variational Principles for Damped Systems, by Morris Morduchow. (53—A-3)

Flexibility of Piping Systems Supported by Equally Spaced Rigid Hangers, by J. E. Brock. (53—A-6)

The Stepped Thrust Bearing—A Solution by Relaxation Methods, by C. F. Kettleborough. (53—A-9)

A Theory of Torsion Bending for Multicell Beams, by S. U. Benscoter. (53—A-27)

Vibrations of Reinforced Shells in a Vacuum and in a Fluid, by M. C. Junger. (53—A-1)

Stress Concentration Due to Elliptical Holes in Orthotropic Plates, by H. D. Conway. (53—A-30)

Bending of Circular and Ring-Shaped Plates on an Elastic Foundation, by Herbert Reismann. (53—A-7)

Contact of Elastic Spheres Under an Oscillating Torsional Couple, by H. Deresiewicz. (53—A-31)

Stress Concentration Due to a Hemispherical Pit at a Free Surface, by R. A. Eubanks. (53—A-8)

Plastic Deformation in a Steel Cylinder Striking a Rigid Target, by E. H. Lee and S. J. Tupper. (53—A-28)

Coulomb Friction, Plasticity, and Limit Loads, by D. C. Drucker. (53—A-57)

The Wave Method for Solving Flexural Vibration Problems, by R. P. N. Jones.

On the Strain Energy of Shells, by H. L. Langhaar and D. R. Carver. (53—A-10)

On Small Spherical or Spheroidal Inclusion in a Twisted Cylinder, by Sisir Chandra Das. (53—A-2)

BRIEF NOTES

Note on Thermal Stresses, by J. L. Bogdanoff.

DISCUSSION

On previously published papers by S. Levy and R. A. Seban; R. W. Cornell; W. N. Findley; E. D. Sweetland and E. R. Parker; G. R. Irwin; W. Prager; H. H. Bleich and F. DiMaggio; W. T. Russell and R. H. MacNeal; Henry Shapiro and D. E. Hudson; J. O. Smith and C. K. Liu.

BOOK REVIEWS

Comments on Papers

Including Letters From Readers on Miscellaneous Subjects

Ludwig Prandtl: 1875-1953

On August 15, 1953, Dr. Ludwig Prandtl died in Göttingen, Germany, in his seventy-ninth year. His death ended a career of a famous engineer and scientist, founder of aerodynamical research in Germany and during many years the director of Kaiser-Wilhelm and Max-Planck Institutes for aerodynamical and hydrodynamical research.

Ludwig Prandtl was born in 1875 in Freising near Munich, in the family of a professor of the school of agriculture. He received his engineering education at the Munich Polytechnical Institute. After graduation, he remained at the school as an assistant of Prof. A. Föppl. At that time he was interested in Strength of Materials and Theory of Elasticity. His Doctor Thesis (1899), dealing with lateral buckling of beams (Kipperscheinungen), attracted a great interest of engineers and opened a new branch of research in the field of elastic stability of structures. This work made him known and as early as 1900 he was invited to take the chair of engineering mechanics at the Hannover Polytechnical Institute. Whilst there, he published his important paper on the *membrane analogy* of the torsion problem, which gave to engineers an important tool for solving complicated elasticity problems by experiment.

Prandtl at Göttingen

Prandtl's accomplishments in engineering mechanics became known to F. Klein, who at that time tried to organize at Göttingen University an institute of applied mechanics. He decided to bring Prandtl to Göttingen and to entrust him with the important work of developing engineering mechanics at that university. Due to Prandtl's activity the Institute of Applied Mechanics at Göttingen became an important center attracting young men interested in the application of mathematical analysis in solving engineering problems. Many present professors of mechanics in Germany and in other countries obtained their graduate training at that institution.

Famous paper on boundary layer

At the beginning Prandtl's work was in the field of elasticity and plasticity, but with the time his interest veered more and more in the direction of aerodynamics and hydrodynamics. In 1904, at the meeting of the International Mathematical Congress in Heidelberg, Prandtl presented his famous paper in which the boundary layer was discussed for the first time.

F. Klein, who heard Prandtl's presentation, at once understood the great importance of the paper to future development of aerodynamics and told his young colleague that his paper was the best in the Congress. In 1908 the first small wind tunnel was constructed in Göttingen to Prandtl's plans. The research work in this tunnel and the techniques of making measurements and of presenting results were so successful that, very soon, experimenters in aerodynamics all over the world accepted Prandtl's methods.

During the First World War, a second (larger) wind tunnel was built at Göttingen, and Prandtl published his outstanding papers on "Tragflügeltheory," which showed how airplanes should be designed on the basis of wind-tunnel experiments with small models. His ideas again won general acceptance and now airplane designers all over the world use them in their work.

The principal characteristic of Prandtl's publications is their originality. His work usually opened new fields for research, and he always had pupils who were ready to follow in the directions indicated by his pioneer researches. In appraising Prandtl's contribution to engineering mechanics, we have to consider not only his publications but also the great school of mechanics which he developed at Göttingen.

Spirit of Prandtl's lifework

Under Prandtl's influence the Society of Applied Mathematics and Mechanics was organized in Germany, of which Prandtl was the president during all his active life. The *Journal* of that society served as an example in organizing similar publications in other countries. All these publications have the purpose of establishing a closer contact between pure science and engineering applications, and this was the actual spirit of Prandtl's lifework.

S. P. Timoshenko.[1]

[1] Professor of Theoretical and Applied Mechanics, Stanford University, Stanford, Calif. Hon. Mem. ASME.

Production Engineering

Comment by James F. Young[2]

This paper,[3] which describes the philosophy of organization for production engineering in the author's company, is a valuable one from several standpoints: (1) It should aid those colleges which are now in process of establishing production-engineering curricula. (2) It should aid production engineers generally in obtaining a better grasp of the engineering functions in their area of endeavor, and the relations between their functions and other engineering functions performed in modern industry. (3) It should prove helpful to those organizations which are faced with reconsolidating their activities after the war and postwar expansion, or which are still in the process of growing.

It is most natural for this paper to stimulate a comparison between the organization described and one's own. In doing this, with respect to the writer's organization, it was found that all the steps listed in its industrial projects occur pretty much as the author lists them, assuming each one may be interpreted in terms of product differences which exist. It also was found that the organization responsibilities listed in Chart 2 were

[2] Consultant, Engineering Surveys and Studies, General Electric Company, New York, N.Y. Mem. ASME.

[3] "Organization for Production Engineering," by R. H. McCarthy, Mechanical Engineering, vol. 75, October, 1953, pp. 785–788, 793.

divided into two areas in our organization. The Engineering Department retains responsibility for items 1, 3, 4, 5, 10, and 12. The Manufacturing Department retains responsibility for items 2, 7, 8, 9, 11, and 13. Both groups make respective contributions to items 6, 12, and 14. This division has been in effect for some time and operates with little confusion among personnel, even those with short experience in the organization.

A natural question which then arises is whether one form of organization might be better than another. The General Electric division of this activity might be considered as similar in relationship to that of the architect and the tradesman. The architect designs the structure and specifies acceptable methods, materials, and quality of construction. The tradesman, specialized in individual skills, provides the tools and performs the actual operations leading to building structure. The Engineering Department in our organization thus includes the engineering responsibilities associated with the product—its form, relationships, performance, and quality. The Manufacturing organization carries responsibility for providing the facilities used and supervising the respective worker skills to produce products meeting the engineering specifications. Although this organization appears to differ from that of the author's company, it is most significant that all the respective activities are represented in each. Division of the activities between groups appears to be an optional matter dependent upon talent available in the organization and to some extent on the particular products involved.

Certainly the paper clearly emphasizes that the field of production involves engineering contributions. This is true, whether one considers only the planning, methods, and layout phases of developing and providing technological facilities for manufacturing; or whether to these are added responsibility for interpretation of design and establishment of quality. In our company, for instance, a manufacturing training program recently has been established for on-job training of engineering personnel for technical and operating responsibilities in manufacturing. This program also recognizes the importance of this growing field of engineering.

Comment by Nevin L. Bean[4]

In the introduction of this paper a very deep-rooted thought was injected, which is the secret to the satisfactory solution of all manufacturing problems. This sentence bears repeating: "Much of the skill of solving problems is in selecting and stating the key problems accurately."

Chart 1 Gives Breakdown

If the problem is understood clearly and the phases of endeavor are planned, the selection of proper personnel to carry out these assignments becomes a much lesser job than trying to select a group of personnel at random for a job that is not clear to those responsible for its completion. In organizing an engineering group, it is quite necessary to understand the know-how available by the various people who will be involved in the original planning and setting up of operations. An outline of the steps in setting up an industrial project has been stated clearly in chronological order, and, in a job of normal or above normal size, none of these steps can be eliminated successfully. By breaking down the progression of organization operation, such as given in the 26 steps shown in Chart 1 of the paper, individual attention can be given to each operation. It must be borne in mind that the most glamorous and important appearing phase is not always the key objective in a project as stated.

The paper breaks down the groups and explains the importance and responsibility of each phase of operation. It must be emphasized that great reliance is placed upon human skills. The human element makes up 100 per cent of modern engineering. This is one phase of industry that has not been mechanized.

A review of various new programs clearly indicates that the proper allocation of responsibility and strict adherence to this policy contribute in a large degree to the success or failure of that program. There should not be an overlap of responsibility, but there should be a definite line of demarcation which is controlled accurately by a co-ordinating group. This co-ordinating group should be allied closely with top management so as to wield the necessary authority and influence to link together the various phases embodied in the development of a new project.

The responsibility of the various sections of production engineering or manufacturing engineering has been defined clearly in the presentation of this paper. The goal of an outlined project has permeated the entire discussion. The only item which might contribute to the thought would be a clear definition of the co-ordination or follow-up which might control the entire program.

This would be listed as a follow-up or co-ordinating operation that would control progress charts and present to top management the advances being made toward the completion of a project. Regardless of the precontrol or the preplanning of a program, many items can be overlooked or omitted because of a lack of proper co-ordination or proper follow-up. This co-ordinating group would not only follow and control the acquisition of the manufacturing equipment to be obtained, but, likewise, would gather together the data and set up information as the equipment is being tried out. Also, they would continue to function until the equipment has been proved or disproved and the parts manufactured have been qualified dimensionally and functionally.

Chart 2 Defines Responsibilities

In Chart 2, defining the responsibilities of a production-engineering organization, the progression of operations has been very well described. The first item noted in this chart, "Assistance to designers in development of product," not only eliminates an enormous amount of excessive manufacturing cost, but also tends to produce a product with higher functional values. This is reflected in determining the types of finish, the types of machining required to produce them, and the ultimate decision of the type of equipment used to manufacture the end product. The remaining fourteen steps as outlined are placed in a constructive manner and, if followed, should result in a highly successful program. The following of this procedure and the assignment of these responsibilities would remove confusion and doubt in planning and developing operations.

The production engineer who personifies the responsibility of the production-engineering department must be familiar with the product; he must be familiar with the methods to produce the product; he must understand all the inspection phases and be able to introduce the quality that is prescribed; he must have a clear sequence of operations defined to permit mass manufacture at a minimum cost; he must understand the materials from which the product is manufactured; he must understand the schedules and be able to provide manufacturing equipment and know-how to produce schedules; he must understand problems normally encountered at the beginning of a program; he must understand the types of tools that can be used for the best manufacturing performance; he must understand coolants and chip-removal problems; he must understand

[4] Manager, Production Engineering Department, Ford Motor Company, Tank Division, Box 2066, Livonia, Mich. Mem. ASME.

the methods of assembly and the part that proper assembly tools must play, and many other phases of manufacturing, engineering, and inspection that normally are encountered in the scope of producing a competitive product. He must be a bumper between manufacturing and engigineering; he also must be a bumper between manufacturing and top management. In other words, a production engineer must personify all of the methods and procedures that are faced in any manufacturing project development.

All this has been explained very effectively and forcefully in the paper.

Comment by F. H. McBerty[5]

This paper defines a broad group of engineering activities that are vitally important in any manufacturing enterprise. The author's company provides a unique background for clear analysis and rational development of management techniques in the area of "production engineering." The company makes a wide range of parts and assemblies requiring an almost infinite variety of skills, raw materials, and manufacturing methods.

A striking aspect of the company's production engineering is the seemingly slight emphasis on functional specialization among its engineers. It would be interesting to know what organizational changes the author would consider desirable if a new plant were built today when experienced engineers are hard to get.

The production-engineering organization described by the author evidently offers unique opportunities for training men for top management. It could provide broad and varied experience not only in technical matters, but also in business economics, in relations with people, in presentation of recommendations, and so on. It would be of interest to hear how these opportunities for training men for management are used for this purpose.

The organization discussed by the author serves several manufacturing units at a single site. He emphasizes the importance of avoiding the error of isolating groups or problems. It would be interesting to know the organization devices used for co-ordination and "cross fertilization" between widely separated sites—for example, between the plants at Baltimore, Hawthorn, and Kearny.

Author's Closure

In the latter part of Mr. Young's comments is the statement "division of the activities between groups appears to be an optional matter, depending upon talent available in the organization and to some extent on the particular products involved."

In the division of activities between groups, the principle I have tried to point out is that all the groups should have skills, functional authority, and budgets with which to work. Specifically, if an organization is responsible for the selection of machines and tools, they should be given power to approve the expenditures for those facilities. If a group is to be established for tool design, it should have draftsmen as well as designers and should have the responsibility of approving all orders for tools.

Meetings to Co-Ordinate Activities

Mr. Bean's comment that the organization is aimed at the adequate handling of specific projects is appropriate. The measure of the organization is its ability to handle difficult projects promptly and at reasonable costs. This requires regularly scheduled co-ordination meetings for the numerous projects that come our way. In the initial stages the meetings are called and led by the engineers. In the later stages, when facilities and processes have been made ready for use, the meetings are led by the production scheduling organizations. A further follow-up comes from a system which makes a regular program of cost reduction.

Results of this program are recorded consistently showing monthly progress. Permanent assignment of manufacturing engineering responsibility by lines of products, rather than temporary assignment, makes one specific group of engineers responsible for providing each shop with methods and facilities which will produce the products specified "dimensionally and functionally."

Mr. McBerty's query of how to get a "new plant built today when experienced engineers are hard to get" deserves comment. Of course, only a small portion of the organization described would be engrossed in the construction of a new building. The building design would come from architects and structural engineers. The layout and equipping of the building is the responsibility of the manufacturing engineers and comes to them as a major project that may for a time require special groupings. But even here, the considerable rotation of personnel between jobs caused by the nature of the business described and requirements for its products and the use of the same procedure throughout the entire engineering organization, whether it is in the product engineering for relays or whether it is in the product engineering for filters, helps to meet the shock of such large projects. Support of these product engineers with groups of specialists so that unusual specialized services are centralized but generally available to the product engineers helps to avoid dissipating the special talents of such personnel in fields other than their specialties.

Opportunities in "Manufacturing Engineering"

It is true that the Manufacturing Engineering Organization offers unique opportunities for training men for top management because of the background acquired in technical aspects of the product and production and in the economics of the business. However, it is not used as a training ground in which to introduce promising personnel purely for training; rather, the promising personnel who are taken into the organization because they are expected to do well in this field serve as a source, after demonstration of their abilities, from which candidates for other opportunities are taken. The net result has been that numerous positions in top management are occupied by people who started in Manufacturing Engineering.

The problem of "co-ordination and cross fertilization" between widely separated manufacturing locations is recognized. For that reason, regular meetings of these organizations from all locations of the company are called by the Engineer of Manufacture of the company for exchange of information and for forward-looking discussions. Likewise, there is exchanged between the locations a regular report describing outstanding engineering developments with their effects upon costs and quality.

R. H. McCarthy.[6]

Polytetrafluorethylene

Comment by D. S. Messenger[7]

The author is to be congratulated on his concise and factual paper.[8] This comment is intended to be in the nature of an amplification, particularly with respect to the uses of Teflon for packing purposes, outlining certain characteristics which influence its uses, and precautions that should be taken in its handling.

[5] Assistant to Chief Engineer, E. I. du Pont de Nemours & Company, Inc., Wilmington, Del. Mem. ASME.

[6] Superintendent of Manufacturing Engineering, Western Electric Company, Kearny, N. J. Mem. ASME.

[7] Assistant Research Director, The Garlock Packing Company, Palmyra, N. Y.

[8] "Polytetrafluorethylene—Its Properties and Uses," by L. W. Cornell, MECHANICAL ENGINEERING, November, 1953, vol. 75, pp. 883–886.

Mention has been made of what is probably its most significant property, namely, its resistance to practically all chemical materials. Consequently, Teflon naturally has become an important material in the packing industry. However, choosing the correct form for any given application is not always a simple matter.

When used as a gasket, Teflon is a hard material which can be made to conform to flange irregularities only under the most heavy bolt loads. Heavy loads are not always feasible in certain types of equipment frequently used in chemical processes—glass-lined for example. A compromise has been effected by the use of French-type gaskets commonly known as "envelope" gaskets in which a relatively soft and deformable material is used as an insert. Typical inserts are asbestos board, folded asbestos-cloth gaskets, and even soft rubber compounds. It should be emphasized that most suppliers of these gaskets feel that it is a mistake to use a soft rubber insert because it is likely to creep and deform excessively under load to the point where the Teflon envelope is ruptured and all protection from the corrosive material being handled is lost. Envelope gaskets have been made 10 ft in diameter.

Other Teflon gaskets are frequently cut from sheet. The author mentioned that sheets $^1/_{16}$ in. thick and heavier were available. Both thickness and size gradually have been increased by improved techniques so that today thicknesses of at least 1 in. in sheets 48 in. square are available.

Teflon as a Pump Packing

As a rotary or centrifugal-pump packing, Teflon is today indispensable, but here again care must be taken in selection because of its propensity to change dimensions with changing thermal conditions. Unless the packing gland is handled with a jeweler's touch, the packing will seize and be destroyed; on the other hand, inadequate tightening will result in excessive leakage. In any case, some leakage must be allowed—the higher the shaft speed the greater the permitted leakage should be.

This problem is aided again by a sort of compromise, the nature of which will appear presently. One type of packing set which is favored consists of end rings of solid Teflon with center rings of compressed but unsintered Teflon, sometimes containing graphite and/or a relatively inert binder. The advantage of such a packing set is that the center rings contain voids which act as safety valves against overtightening or seizing.

Another favorite pump packing is an asbestos braid treated with Teflon suspensoid. Both white and blue asbestos variations are available, but only the blue type is chemically resistant throughout and should be preferred. Here again, the presence of voids in the braid contributes largely to its usefulness. The types, which have just been discussed, find some application as valve-stem packings also, although solid Teflon valve-stem packings are perhaps used more frequently.

Molding techniques have been improved to the point where almost any desired shape can be molded. However, economic reasons may dictate that other methods, such as machining from solid material, be employed. Reasonably close tolerances are possible by either method.

Mention should be made of the practice of compounding Teflon with inert fillers such as asbestos, glass fiber, graphite, calcium fluoride, or metal powders. Incorporation may be made directly to molding powder in a dry mix, or by adding the fillers to the suspensoid and coagulating *in situ*. Presence of the filler dilutes the Teflon, resulting in a less thermoplastic, though harder, product. Such materials have been used for bearings.

The writer might elaborate on such products as elements in radial seals, diaphragms, expansion joints and many others, but space does not permit this. In a few years time, Teflon has carved such a niche for itself in so many industries that one wonders how we ever got along without it. There is no doubt that it will continue to grow in usefulness.

Author's Closure

The information which Mr. Messenger has supplied on gasket uses of Teflon[9] is a welcome addition to the original paper, which was of necessity quite general in its coverage. He is an expert in this field and the application details he gives will be very helpful.

Since the presentation of the paper before ASME, two very significant advances have been made in Teflon film technology. There is now available a special nondirectional fused Teflon film in calipers suitable for fabrication into liners, bags, bladders, bellows, diaphragms, and the like. This special film is tough and strong and was developed to resist cracking at very low temperatures. It has the high-temperature resistance of Teflon, of course. In addition, effective methods are now available for heat-sealing this nondirectional film to itself for fabrication into a wide variety of sizes and shapes. The seal contains only Teflon, and so none of the outstanding qualities of the plastic are sacrificed. Peel strengths of 10 to 20 lb per in. of seam width are obtainable by these methods. This new type of film and the methods of heat-sealing it promise to extend the already wide usefulness of Teflon.

L. W. Cornell.[10]

[9] Registered Trademark of E. I. du Pont de Nemours & Co., Inc., for its polytetrafluoroethylene resin.

Powered Flight

Comment by Francis Morse[11]

The recent anniversary article[12] on the role of the ASME in the development of powered flight forms an exciting commentary on the rise of the airplane to its present pinnacle of preeminence. It is a record of achievement which would appear to fully affirm the 1881 prediction of ASME President Thurston to which both the present article and editorial comment[13] made reference, to wit "Our only hope lies in the direction of flying machines, lifted by their own power, not buoyed up by gas."

May I point out, however, that President Thurston in making this forecast of victory for heavier-than-air over lighter-than-air craft quite evidently never foresaw the evolution of the balloon into the rigid airship, only a few decades later. We must remember that the airship, though now in eclipse, reached a high degree of development, and among its other notable achievements initiated the first scheduled transoceanic commercial passenger service.

The author touches briefly on lighter-than-air development further on in his highly absorbing account, and quite excusably treats it as a closed book. But I should like to venture the suggestion that the last chapter in the history of rigid airship development has yet to be written. The great technological advances of the past two decades and the advent of nuclear power for aircraft should, if applied to a large rigid airship of modern design, produce a formidable

[10] Assistant Manager, New Products Application, Tape Technical Service, Minnesota Mining & Manufacturing Company, St. Paul, Minn.

[11] General Electric Co., Pittsfield, Mass.

[12] "ASME Role in Powered Flight," by H. F. Reeve, MECHANICAL ENGINEERING, December, 1953, vol. 75, pp. 987-999.

[13] Ibid., p. 951.

competitor to both the airplane and the steamship on transoceanic routes. *The problems of adapting nuclear power will be fewer, and the advantages accrued by it will be more for lighter-than-air craft than for heavier-than-air craft.*

The rigid airship, dogged by misfortune in its formative years and overshadowed by the triumphant rise of the airplane, has, I maintain, never received a fair evaluation of its potentialities. With the enormous amount of investment capital available in this country and the huge and ever-growing field of travel spreading all around us, it would be shameful if so promising a branch of transportation were allowed to languish indefinitely in neglect. I am confident that it will not.

Author's Closure

Mr. Morse's comment is interesting and has a high degree of merit. I agree with his view that the airship has not reached its final chapter. I did not intend to convey the impression that it is a closed book; in fact, it was stated on page 991 that "The airship continues to survive for military applications..."

However, the primary purpose of the article was to review the role of the ASME in the development of powered flight, and the account covered just about all of the published work of the Society in that field.

With regard to the future of the airship, I referred Mr. Morse's comments to Admiral C. E. Rosendahl, one of the world's great authorities on lighter-than-air. His remarks in that connection follow.

Harris F. Reeve.[14]

Remarks by Admiral C. E. Rosendahl

From the quoted 1881 prediction of ASME President Thurston one might conclude that neither contemporary aeronautics nor man's perception had yet matured enough to apply the principle of specialization to air transportation. There obviously were then, and unfortunately still are, some who visualize the powered balloon and the heavier-than-air machine as competitors.

Now, however, with the admitted benefit of hindsight, one can question how there could be a "victory" of one type over another when logically there is no conflict.

[14] Flight Safety Foundation, New York, N. Y.

I am unable to discern clearly what President Thurston intended by "our only hope". If he meant the simple hope of successful powered flight, then obviously his prophesy has been punctured by every airship that has ever flown. It may well have been that in 1881 men considered powered propulsion of airships an insuperable task. Actually, it is a less difficult matter than in the case of heavier-than-air aircraft.

I agree thoroughly with Francis Morse that the history of rigid (large) airships has yet to be written.

Helium, metal hulls, boundary-layer control, nuclear power plants; the many other modern developments in aeronautical knowledge, materials, instruments, communications; and honest intentions and effort—these are the ingredients from which dispassionate minds some day will produce an almost entirely new breed of airship. It will be a vehicle that open minds will welcome for the many specialized tasks it can do, military and civil, better than any other type.

It is certainly to no one's credit that our thinking on airships to date has been so unproductive, unrealistic, confused, and craven.

Reviews of Books

And Notes on Books Received in Engineering Societies Library

Discontinuous Automatic Control

DISCONTINUOUS AUTOMATIC CONTROL. By Irmgard Flügge-Lotz. Princeton University Press, Princeton, N. J., 1953. Cloth, 6 × 9 in., figs., tables, appendixes, viii 168 pp. + index, $5.

Reviewed by Rufus Oldenburger[1]

AN ON-OFF control is often the simplest and most economical solution to an automatic control problem. It does not always give the best transients, but there are many places where engineering performance can be sacrificed to make use of such a control. Actually the writer has found that there are applications where on-off controls give optimum transients. Discontinuous controls find extensive use in expendable military equipment such as guided missiles. With the current interest in discontinuous controls of the on-off variety it is no wonder that a book devoted entirely to the theory of this subject has finally appeared.

Much of the literature on discontinuous controls has been published in Germany, where Dr. Flügge-Lotz was a pioneer in the subject. Through her book this and other work are now made immediately accessible to the English-speaking public.

The two types of on-off control in current use are those of position and velocity. It is with these types that the volume of Dr. Flügge-Lotz is concerned. Most of the book is restricted to second-order systems with one degree of freedom. This restriction is justified because of the large number of applications that fall in this class. Mathematical solutions of the differential equations are given for the cases where the control is assumed to be perfect and the controlling function is a linear expression in the controlled variable and its derivative. For velocity control the case of feedback with the controlling function linear in the control element is also covered. The author recognizes that physical equipment can only approximate ideal performance, and she therefore treats three types of imperfections. These concern the subjects of

[1] Director of Research, Woodward Governor Company, Rockford, Ill. Mem. ASME.

threshold, dead time, and neutral zone. The author shows that the imperfections may be favorable and that one can compensate for neutral zones with time lags.

The use of phase space in analyzing discontinuous controls is now quite common. The phase-space approach is employed in the book to give the engineer a visual picture of what happens during transients. With such a picture the influence of different physical factors on the over-all performance of the system is readily demonstrated.

The theory is extended to the case of the longitudinal motion of a guided missile under discontinuous position control. This motion is one with three degrees of freedom.

This volume is one that should prove to be of considerable value to the scientific designer of on-off controls. This is particularly so in that the mathematics necessary to understand the subject is not avoided.

Books Received in Library...

ANNUAL REVIEW OF NUCLEAR SCIENCE, VOL. 3. Edited by James G. Beckerley. Annual Reviews, Inc., Stanford, Calif., 1953. 412 p., 9 × 6¼ in., bound. $7. The fifteen papers contained in the broadened scope of this third volume cover a considerable range of topics, including the following: reactions of mesons with other particles, neutron optics, photographic emulsions, separation techniques used in radiochemistry, isotope effects in chemical reactions, radiation dosimetry and protection, practical aspects of radiation injury, and vertebrate and cellular radiobiology. Essentially a literature survey with extensive reference lists.

APPLIED ELASTICITY. By Chi-Teh Wang. McGraw-Hill Book Company, Inc., New York, N. Y., 1953. 357 p., 9¼ × 6¼ in., bound. $8. A textbook for graduate courses intended to perform two major functions: To provide the student with the necessary fundamental theoretical knowledge so that he will be able to formulate any problem occurring in the classical theory of elasticity; and to acquaint him with the most useful analytical and numerical methods for solving any such formulated problem.

APPLIED THERMODYNAMICS. By A. C. Walshaw. Blackie & Son Ltd., Glasgow, second edition, 1953. 612 p., 8¾ × 6¼ in., bound. 40s. Intended as a review text, this volume deals with the principles and general theory of thermodynamics and their application to the steam plant, internal-combustion engines, compressors, and refrigeration. A new 60-page chapter on gas-turbine plant has been added to the section on internal-combustion engines. There are a great many worked examples and exercises.

BESSEL FUNCTIONS AND FORMULAE. Compiled by W. G. Bickley. Cambridge University Press, New York, N. Y., 1953. 12 p., 11 × 8½ in., paper. $0.75. A reprint of the section on "Functions and Formulae" from the British Association Mathematical Tables, vol. 10, Bessel Functions, part 2; intended to provide, in an easily handled form, these fundamental mathematical tools.

CANADIAN TRADE INDEX, 1953. Canadian Manufacturers' Association, Inc., Toronto, Canada, 1953. 1126 p., 10¼ × 6¾ in., bound. $7.50. This standard directory lists alphabetically over 10,000 firms with addresses, branches, export representatives, trademarks and so on. A classified list of products is included, and there are special sections giving information on Canada's export trade, a survey of its industry, and a list of producers, shippers, and exporters of agricultural produce. French equivalents of the product classifications are also provided.

CONGRÈS DES MATÉRIAUX RÉSISTANT A CHAUD, 1951. Association pour l'Encouragement a la Recherche Aéronautique. Éditions Métaux, Saint-Germain-En-Laye, France, 1953. 398 p., 10½ × 8¼ in., paper. 5000 fr. The volume opens with a group of introductory papers on various general aspects of heat-resistant materials. The subsequent papers are broadly grouped under the following subjects: creep of metals; furnaces and instruments; light-metal alloys; austenitic and martensitic alloys and other heat-resistant steels; superresistant metals (tungsten, sintered materials, etc.) and metallo-ceramics; carbides, graphites, and special ceramic materials; other special materials, such as silicons.

CONSTRUCTION METHODS AND MACHINERY. by F. H. Kellogg. Prentice-Hall, Inc., New York, N. Y., 1954. 415 p., 8¾ × 6 in., bound. $10. In this book the principles of scientific management are applied to construction work. Part 1 treats planning of operations, control of work for maximum production, and economics of equipment—selection, costs, depreciation, etc. Part 2 discusses the fundamentals and economical utilization of machinery for power, transportation, hoisting and conveying, and pumping. In the third part, about half the book, methods of conducting specific operations are described and evaluated.

DIMENSIONING OF ENGINEERING DRAWINGS. By W. Abbott. Blackie & Son, Ltd., Glasgow, Scotland, 1953. 186 p., 8¾ × 6 in., bound, 10s 6d. A practical text on the principles which govern the dimensioning of drawings for engineering components in their finished state when interchangeability is a requirement. It is concerned with the distribution of tolerances previously decided upon, not with the determination of these tolerances. In addition to a thorough treatment of general principles, a considerable number of special conditions are dealt with.

ENERGY IN THE FUTURE. By Palmer Cosslett Putman. D. Van Nostrand Company, Inc., New York N. Y., 1953. 556 p., 9¼ × 6½ in., bound. $12.75. A study of the maximum plausible demand for energy on a world scale over the next 50 to 100 years, originally prepared for the Atomic Energy Commission as background for consideration of probable demands for low-cost energy from nuclear fuels. The author reviews rates of population growth, demands for energy, economically recoverable reserves of fuels, and such sources of energy as water power, the sun, and others. Estimates of probable demands for energy and of the role of nuclear fuels are made. A bibliography is included.

ENGINEERING ALLOYS. By Norman E. Woldman. American Society for Metals, Cleveland, Ohio, revised 1954. 1034 p., 9¼ × 6¼ in., bound. $15. Section 1 of this highly useful compilation is an alphabetical list of alloys with corresponding serial numbers assigned by the compiler. In the more than 600 pages of Section 2 are given the alloy trade name, composition, properties, typical uses, and key numbers designating the manufacturers; the alloys are listed by serial number. Section 3 is an alphabetical list of manufacturers with their addresses and a summary of the alloys produced by each. Section 4 lists the manufacturers by the key index numbers given in Section 2. Some 7000 new proprietary alloys have been added in this new edition.

ENGINEERING THERMODYNAMICS. By Byron E. Short, Harry L. Kent, Jr., and Burnett F. Treat. Harper & Brothers, New York, N. Y., 1953. 467 p., 9½ × 6¼ in., bound. $6. A textbook for the standard junior-year course in thermodynamics, presupposing calculus, engineering mechanics, and elementary chemistry and physics. The book covers the usual subjects, but offers several changes in the order of presentation; e.g., properties of solids, liquids, and vapors are discussed before those of ideal gases, and entropy is introduced early as a basic property and working tool.

EXPERIMENTELLE UND THEORETISCHE UNTERSUCHUNGEN AN DUNNEN PLATTEN. (Publications du Laboratoire de Photoélasticité, E.P.F., no. 5.) By Bernhard Gilg. Éditions Leemann, Zurich, Switzerland, 1952. 100 p., 9½ × 6¾ in., paper. 12.50 Sw. fr. Experimental and theoretical investigation on thin plates. Part 1 deals with photoelastic methods for determining internal stresses, including the necessary fundamental theory. Part 2 presents a theoretical consideration of circular plates of variable thickness.

LES FONTES SPECIALES. Leur Élaboration-Leurs Emplois. By O. Bader and D. Godot. Éditions Eyrolles, Paris, France, 1953. 296 p., 10 × 6½ in., paper. 1820 fr. A detailed treatment of the preparation and metallurgical characteristics of a wide range of castings: nickel, chromium, molybdenum, and aluminum; several special types of iron and steel—malleable, spheroidal graphite, etc.; castings with high silicon content. The influence of alloying elements and of various heat-treatments is discussed, melting furnaces are briefly described, and castings are cross-classified by their properties for effective utilization.

FORCED OSCILLATIONS IN NON-LINEAR SYSTEMS. By Chihiro Hayashi. Nippon Printing and Publishing Company, Ltd., Osaka, Japan, first edition, 1953. 164 p., 10¼ × 7½ in., bound. $4.50. A detailed treatment for engineers and physicists, dealing only with systems having one degree of freedom. It applies a comprehensive method of analysis to a wide variety of periodic oscillations; Part 1 dealing

Library Services

ENGINEERING Societies Library books may be borrowed by mail by ASME Members for a small handling charge. The Library also prepares bibliographies, maintains search and photostat services, and can provide microfilm copies of any items in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th St., New York 18, N. Y.

with steady-state conditions; Part 2, with the transient state of oscillations leading to the steady state. Emphasis is on the comparison of conclusions derived from theory with experimental investigations carried out using electrical oscillatory circuits with saturable iron cores as the nonlinear element.

FORMULAS FOR STRESS AND STRAIN. By Raymond J. Roark. McGraw-Hill Book Company, New York, N. Y., third edition, 1954. 381 p., $8^1/_4 \times 6^1/_4$ in., bound. $7.50. A working handbook for machine and structural designers, which summarizes formulas, facts, and principles relating to strength of materials. Parts 1 and 2 cover definitions and symbols, general principles, methods of stress analysis, and the behavior of materials under stress. Part 3, the major section, describes in detail the behavior of structural elements under various conditions of loading, with extensive tables of formulas for calculating stress, strain, and strength. In this edition, new data have been added throughout.

DIE GASMASCHINE. (Die Verbrennungskraftmaschine, vol. 5.) By Max Leiker. Springer-Verlag, Vienna, Austria, second edition, 1953. 260 p., $10^1/_2 \times 7^1/_2$ in., paper. $11.45. Part of a general series on "the internal-combustion engine", this volume deals primarily with research and experience on the German Deutz engine but also includes information from the literature of other German and foreign manufacturers of gas engines. Chapters cover fundamentals, gas engines with diesel compression, two-cycle gas engines, accessories, examples of design and construction, waste-heat utilization.

GEARS FOR SMALL MECHANISMS. By W. O. Davis. N. A. G. Press, Ltd., London, England, 1953. 157 p., $8^1/_2 \times 5^1/_2$ in., bound. 25s. Both the designer and user of small mechanisms containing gearing will find this book of interest. It covers both theory and practice of the design of cycloidal gears, and discusses in detail such problems as friction and efficiency of tooth action, design of gear-cutting tools, and the production and testing of gears for watches, clocks, automatic-control mechanisms, and other devices.

GEWINDEWALZEN. By Heinz Apel. Carl Hanser Verlag, Munich, Germany, 1952. 255 p., $8^1/_2 \times 6$ in., bound. 24.80 Dm. This comprehensive, practical treatise describes the possibilities, requirements, and actual methods of thread rolling. It covers the physical phenomena involved (plastic deformation, etc.), detailed operational procedures with rotary tools, and descriptions of the various types of thread-rolling machines.

HANDBOOK OF PROBABILITY AND STATISTICS WITH TABLES. By Richard Stevens Burington and Donald Curtis May. Handbook Publishers, Inc., Sandusky, Ohio, 1953. 332 p., $8 \times 5^1/_2$ in., bound. $4.50. This summary of theory, working rules, and tabular material provides a compilation of selected data for all engineers and research workers who have use for statistical procedures. Particularly useful for operations research and analysis, the book provides basic data for evaluation of performance and worth, quality control, and other management problems.

HANDBOOK OF STANDARD TIME DATA. By Arthur A. Hadden and Victor K. Genger. Ronald Press Company, New York, N. Y., 1954. 473 p., $9^1/_4 \times 6^1/_4$ in., bound. $10. The standard times for machine-shop operations presented in this handbook can be used by plant engineers and managers to determine in advance of production the best sequence and most economical methods of operations and a standard time for a fair workday for the average man. For the most part data are given in tabular form and separate tables are provided for each machine tool.

HYDRAULIQUE TECHNIQUE. By Charles Jaeger. Dunod, Paris, France, 1954. 510 p., $9^3/_4 \times 6^1/_2$ in., bound, 4900 fr. Beginning with a section on fundamental hydraulic principles, this text has three subsequent major sections on steady flow, unsteady flow, and flow in underground strata. Particular attention is paid to basic hydrodynamic equations, open-channel flow, surge tanks, and water hammer. An appendix discusses experimental values for hydraulic calculations dealing with the effect of bends and other physical conditions.

DER INDUSTRIELLE WARMEUBERGANG. By Alfred Schanck. Verlag Stahleisen, Dusseldorf, Germany, fourth edition, 1953. 400 p., $9^1/_4 \times 6^1/_2$ in., bound. 38.50 Dm. This new edition of a standard German treatise on the theory and practice of heat transfer provides the practicing engineer with the necessary fundamental technical information available as of 1952. The data presented are drawn from English and American sources as well as German.

INTRODUCTION TO A STUDY OF MECHANICAL VIBRATION. By G. W. Van Santen. Philips' Technical Library, Eindhoven (available in U. S. from Elsevier Press, Inc., Houston, Texas) 1953. 296 p., $9^1/_4 \times 6^1/_4$ in., bound. $7.50. A review of the elementary theory of mechanical vibrations and of some of the practical problems encountered by engineers. The book covers a wide variety of subjects as starting points for further study, while at the same time suggesting practical methods for solving particular problems. It deals with the theory of damped and undamped free and forced vibrations, bending and torsional vibrations in shafts, equipment and instruments for measuring vibrations.

JAHRBUCH DER WISSENSCHAFTLICHEN GESELLSCHAFT FUR LUFTFAHRT, 1952. Edited by Hermann Blenk. Friedr. Vieweg & Sohn, Braunschweig, Germany, 1953. 148 p., $11^3/_4 \times 8^1/_2$ in., bound. 24 Dm. A wide range of topics is covered by the papers presented at this German conference: wind-tunnel developments; boundary suction as an aerodynamic aid; production of smooth wing surfaces; weight-saving construction methods for airplanes; aircraft-propulsion methods, with separate papers on piston engines, turbo-engines, and ram jets; air-navigation systems.

JANE'S ALL THE WORLD'S AIRCRAFT, 1953–1954. Edited by Leonard Bridgman. McGraw-Hill Book Company, Inc., New York, N. Y., 1953. 352 p., $12^3/_4 \times 8^1/_4$ in., bound. $23. This new edition, considerably revised, contains descriptions and specifications of aircraft of twenty-nine countries, with 620 illustrations, 370 of them new. Other features of the book are a directory of commercial airlines of the world, giving number and types of planes owned and statistics on operations; an engine section giving data on power-plants of all types, including rocket motors, ramjets, and pulsejets; and a section on airships.

LA MACHINE-OUTIL. Edited by A. R. Métral. Dunod, Paris, 1953. Volume 1: Généralitiés- Machines-Outils Et Usinage. 336 p., $11 \times 7^1/_2$ in., bound. 4400 fr. Volume 4: Usinage Par Outils En Translation. 351 p., $11 \times 7^1/_2$ in., bound. 4600 fr. Vol. 1 of this set begins with an introductory discussion of machine tools and the machine-tool industry in the principal countries of the world. It then deals with the following topics: metalurgy in relation to metal cutting; design of castings for machine elements; theoretical and practical aspects of metal-cutting with tools of various types; cutting fluids; maintenance. Vol. 4. provides detailed coverage of planning, shaping, mortising, slotting, and broaching machines including operation analysis.

LEADERS IN AMERICAN SCIENCE, 1953–1954. Edited by Robert C. Cook. Who's Who in Education, Inc., Nashville, Tenn., first edition, 1953. 703 p., $9^1/_2 \times 6^1/_4$ in., bound. $12. The first volume of an intended biennial series, this directory lists some 13,500 scientists, with biographical information when supplied, and in some cases, photographs. Among those included are all Fellows of national science organizations; all members of the National Academy of Science, Sigma XI, and similar organizations; and hundreds who were personally recommended by other scientists. A special feature is a classified list of men and women selected as the most distinguished in their fields by a poll of scientists.

MOTEURS ET TURBINES A COMBUSTION INTERNE. By M. Seidiger. Dunod, Paris, France, 1953. 298 p., $9^1/_2 \times 6^1/_4$ in., bound. 2950 fr. Part 1 of this text deals with reciprocating internal-combustion engines, both gasoline and heavy-oil types, covering thermodynamic fundamentals, operating principles, combustion characteristics, and supercharging. Part 2 provides similar condensed coverage for gas turbines, reaction motors, and combined power-plants for aircraft.

PRINCIPLES OF NUMERICAL ANALYSIS. By Alston S. Householder. McGraw-Hill Book Company, Inc., New York, N. Y., 1953. 374 p., $9^1/_4 \times 6^1/_4$ in., bound. $6. A unified presentation that develops the mathematical principles upon which many computing methods are based. Directed primarily toward high-speed digital computation, the book also contains much useful material for "hand" computation. It covers specifically matrices and linear equations, nonlinear equations, interpolation and other approximations, and the Monte Carlo method.

PROCEEDINGS OF 1953 CONFERENCE ON NUCLEAR ENGINEERING. University of California, Berkeley, Sept. 9–11, 1953. California Book Company, Ltd., Berkeley, Calif., 1953. Various paging, $10^3/_4 \times 8^1/_4$ in., paper. $7.50. Thirty-three contributed papers on nuclear power are reprinted under the following subject groups: reactors—power and research; equipment for neutron research; nuclear power-plant economics; nuclear kinetics, instrumentation, and control; materials for reactor components; accelerator engineering; uses of isotopes and nuclear radiations. Two special papers deal with a nuclear-power program and metals for reactor-core construction.

REPORT ON THE ELEVATED-TEMPERATURE PROPERTIES OF CHROMIUM-MOLYBDENUM STEELS. (Special Technical Publications, No. 151.) American Society for Testing Materials, Philadelphia, Pa., 1953. 208 p., $11 \times 8^1/_2$ in., paper. $7.75. A graphical summary for 23 steels, which includes curves for tensile strength; 0.2 per cent offset yield strength; per cent elongation and reduction of area; stresses for rupture in 100, 1000, 10,000 and 100,000 hours; Larson-Miller parameter curves; and stresses for two different creep rates. The data sheets in the appendix from which the curves were prepared also give other pertinent data for these 23 steels and for some 30 others as well.

STRESS CONCENTRATION DESIGN FACTORS. By R. E Peterson. John Wiley & Sons, Inc., New York, N. Y., 1953. 155 p., 11¼ × 9½ in., spiral binding. $8.50. Intended as a working tool, not a textbook, this book provides the designer with information which will enable him to avoid failures due to stress concentration. The effects of grooves, notches, fillets, holes, etc., are determined theoretically and examined practically, the pertinent quantitative factors being expressed in the form of full-page charts and graphs. The major sections are thumb-indexed for quick reference.

SYMPOSIUM ON PLASTICS TESTING—PRESENT AND FUTURE. (Special Technical Publication, No. 132.) American Society for Testing Materials, Philadelphia, Pa., 1953. 71 p., 9 × 6 in., paper. $2. This symposium was designed to describe the present status of testing procedures and indicate the directions which future efforts at standardization may take. The papers examine the situation with regard to mechanical, thermal, optical, molding, and permanence properties, and conditioning and weathering of plastics, including a study of internal states of stress in cross-linked polymers.

SYMPOSIUM ON TIN. (Special Technical Publication, No. 141.) American Society for Testing Materials, Philadelphia, Pa., 1953. 111 p., 9 × 6 in., paper. $2.50. As a preliminary to the establishment of standards and specifications relating to tin this symposium presents some organized information on various aspects of the matter: production and resources; tin coatings; use of tin in the container industry and in automobile bodies; the effect of impurities in tin and their determination; the analysis of tin in general.

TABLES OF BAROMETRIC PRESSURES AT VARYING TEMPERATURES. By J. D. W. Ball. Constable & Company, Ltd., London, England, 1953. 23 p., 8½ × 5½ in., paper. 5s. Conversion tables giving the following equivalents: millimeters of mercury to kilograms per square centimeter; inches of mercury to pounds per square inch, and to pounds per square foot; kilograms per square centimeter expressed as bars.

TABLES OF NATURAL LOGARITHMS FOR ARGUMENTS BETWEEN ZERO AND FIVE TO SIXTEEN DECIMAL PLACES. (Applied Mathematics Series, No. 31.) National Bureau of Standards. Available from Superintendent of Documents, Government Printing Office, Washington, D. C., 1953. 501 p., 10½ × 8 in., bound. $3.25. This table of logarithms to the base covers the indicated range of intervals of .0001. As in the case with all volumes in this series an introductory section explains both the methods of calculation and the effective use of the tables.

TABLES OF 10^x. (Applied Mathematics Series, No. 27.) National Bureau of Standards. Available from Superintendent of Documents, Government Printing Office, Washington, D. C., 1953. 543 p., 10½ × 8 in., bound. $3.50. Antilogarithms to the base 10 are tabulated to 10 decimal places from 0 to 1 at intervals of .00001; a revision, with corrections, of the Dodson table of 1742.

THE THEORY OF METALS. By A. H. Wilson. Cambridge University Press, New York, N. Y., second edition, 1953. 346 p., 10½ × 7½ in., bound. $8.50. A systematic, theoretical account of the electronic properties of solids. Basic ideas are introduced in the first two chapters, followed by the application of these ideas to the problems of metallic structures, semiconductors, thermal and magnetic properties of metals, ferromagnetism, and the mechanism of conductivity. In the extensive revision the chapters on superconductivity and optical properties have been deleted.

WELDING ENGINEERING. By Boniface E. Rossi. McGraw-Hill Book Company, Inc., New York, N. Y., 1953. 786 p., 9¼ × 6¼ in., bound. $8. This comprehensive survey of welding engineering provides fundamentals for the student or beginner and a wider understanding for those now in the field. It can also be used as a reference manual by engineers, designers, and others. The four main sections of the book cover welding processes, metals and their weldability, design and fabrication considerations, and testing and inspection of welds.

ASME BOILER CODE

Interpretations

THE Boiler Code Committee meets monthly to consider "Cases" where users have found difficulty in interpreting the Code. These pass through the following procedure: (1) Inquiries are submitted by letter to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N. Y.; (2) Copies are distributed to Committee members for study; (3) At the next Committee meeting interpretations are formulated to be submitted to the ASME Board on Codes and Standards, authorized by the Council of the Society to pass upon them; (4) They are submitted to the Board for action; (5) Those which are approved are sent to the inquirers and are published in MECHANICAL ENGINEERING.

(The following Case Interpretations were formulated at the Committee meeting January 22, 1954, and approved by the Board on March 5, 1954.)

CASE No. 1173

(Special Ruling)

Inquiry: Will unfired pressure vessels fabricated by fusion welding under the applicable rules of Section VIII, 1952 edition, meet the intent of the Code if the base material is a nickel-molybdenum wrought material, which is now under consideration by the appropriate ASTM Committee, having the following composition:

	PER CENT
Molybdenum	26.00 to 30.00
Iron	4.00 to 7.00
Vanadium	0.20 to 0.60
Silicon, max	1.00
Phosphorus, max	0.04
Sulfur, max	0.03
Manganese, max	1.00
Chromium, max	1.00
Carbon, max	0.12
Cobalt, max	2.50
Other, total, max	0.50
Nickel	remainder

Reply: It is the opinion of the Committee that the nickel-molybdenum alloy described in the Inquiry may be used for the construction of unfired pressure vessels according to the applicable rules of Section VIII, 1952 edition, subject to the following conditions:

(1) The mechanical properties of the material are not less than the following:

Thickness, in.	Tensile Str., psi	Yield Str., psi, 0.2 % Offset	Elongation in 2", % Min
Up to 3/16	115000	50000	45
Over 3/16 to 3/4	100000	45000	40
Over 3/4 to 1 1/2	90000	45000	35

(2) Fabrication is by fusion welding using filler metal complying in composition with the base material.

(3) The welding requirements and applicable paragraphs of Section IX, 1952 edition, apply except that the tensile strength of the reduced section specimen shall be not less than the specified tensile strength of the base material.

(4) Fusion welded butt joints shall be examined radiographically for their full length as prescribed in Par. UW-51 when the plate or vessel wall thickness at the welded joint exceeds 3/8 in. All fusion butt joints regardless of thickness shall be examined by the fluid penetrant method.

(5) The following maximum allowable stress values are used in applying the design rules where reference is made to Table UNF-23:

Metal Temperatures Not Exceeding Deg F						
100	200	300	400	500	600	650
22000	20000	20000	20000	20000	20000	20000

(6) In view of the fact that this alloy does not undergo a marked drop in impact resistance at low temperatures, no additional requirements are specified for temperatures down to —325 F (see Par. UNF-65).

(7) The joint efficiency factors, inspection, and testing comply with the applicable paragraphs of Section VIII, 1952 edition.

(8) The minimum thickness after forming of any plate subject to pressure shall be $^3/_{32}$ in. (See Par. UG-16(c) for permissible undertolerance.)

(9) Bolting materials shall comply in composition with the base material or one of the grades of steel bolts listed in Table UCS-23. The allowable stress values for nickel-molybdenum alloy bolts shall be as follows:

Metal Temperatures Not Exceeding Deg F			
100	200	300	400
8000	8000	7600	7200
500	600	650	
7000	6800	6800	

NON-MANDATORY APPENDIX

(1) Heat-treatment, including stress relief of welded vessels, is neither required nor prohibited. When maximum corrosion resistance is required, it may be advisable to heat-treat in such a manner as to place all carbides in solution. For such service it is recommended that the vessel be heated to the range 2100 F to 2150 F and held for not less than 1 hr per in. of thickness. Quench all parts of the vessel uniformly and as rapidly as possible in water or air. The material should be cooled through the range from 1800 F to 1100 F in not more than 10 minutes. In order to avoid incipient fusion and the consequent decrease in corrosion resistance, heating above 2150 F should be avoided.

(2) Welding techniques that will preserve the corrosion-resistant properties of the alloy should be used. In general, welding should be performed using stringer bead techniques with little or no weaving of the welding electrode or rod.

CASE NO. 1182

(Special Ruling)

Inquiry: Is it permissible to construct unfired pressure vessels of ferrous* material fabricated by fusion welding for service at operating temperatures below —20 F when the weld filler metal has lower mechanical properties than the base metal?

Reply: It is the opinion of the Committee that weld filler metal having lower mechanical properties than those of the base metal may be used for the construction of pressure vessels, when made of ferrous materials, to operate at temperatures below —20 F with the following provisions:

(1) Materials and design of such vessels shall meet the requirements of Section VIII of the Code with particular reference to the requirements of Pars. UG-84, UCS-65, UCS-66, UCS-67, and UHA-51.

(2) The welding requirements of Section IX shall be met except as specifically exempted in (3).

(3) The room-temperature tensile strength of the weld, as determined by the reduced section tensile test made to qualify the welding procedure as prescribed in Section IX, shall be not less than 90 per cent of the minimum specified tensile strength of the base metal.

(4) The stress value to be used for design purposes shall be 90 per cent of the room-temperature stress value of the base metal.

CAUTION: It is recommended that the tensile strength of the weld, as determined by the reduced-section tensile test, be greater than the yield strength of the base metal as given in the mill test reports.

* As used herein ferrous materials include carbon, low-alloy, and high-alloy steels.

Proposed Revisions and Addenda to Boiler and Pressure Vessel Code . . .

AS NEED arises, the Boiler Code Committee entertains suggestions for revising its Codes. Revisions approved by the Committee are published here as proposed addenda to the Code to invite criticism. If and as finally approved by the ASME Board on Codes and Standards, and formally adopted by the Council, they are printed in the annual addenda supplements to the Code. Triennially the addenda are incorporated into a new edition of the Code.

In the following the paragraph numbers indicate where the proposed revisions would apply in the various sections of the Code.

Comments should be addressed to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N. Y.

Power Boilers, 1952

TABLE P-7 Revise as follows:

For SA-268-47, Grades TP-405, TP-410, and TP-430, add the same stress values as given for Table UHA-23 in the September, 1953, issue of MECHANICAL ENGINEERING.

Delete the following specifications: SA-158, SA-206, SA-280, SA-315, SA-83 (lap-welded pipe and tubes), and SA-157.

Make the following changes in grade designations:

Specifications	Old Grade Designations	New Grade Designations
SA-213	T13	T5b
	T14	T3b
SA-335	P5a	P5
	P16	P7
	P17	P9
SA-182	F17	F9
	F2	F12
	F8	F304
	F8m	F316
	F8t	F321
	F8c	F347

Under "Notes," add "(1)" after SA-299.

Delete the designation "Grade A" after SA-192.

Change the heading "Electric-Resistance-Welded Alloy Steels" above SA-249 to read "Welded Alloy Steels."

Change the nominal composition of SA-217, WC4 to read "Ni-Cr-$^1/_2$ Mo."

Add the maximum allowable stress values given elsewhere on this page.

TABLE P-15 Delete the present Table P-15 and substitute the following:

Table P-15 Maximum Boiler Pressures for Use of American Standard Carbon Steel Pipe Flanges, Fittings, and Valves

Primary Service Pressure Rating	Type of Flange Facing[3]	Maximum Allowable Boiler Pressure, psig Except as Noted: Steam Service at Saturation Temperature[1]	Maximum Allowable Boiler Pressure, psig Except as Noted: Boiler Feed and Blowoff Line Service[2]
150	Class A	190	160
	Class B	180	150
300	Class A	630	515
	Class B	510	415
400	Class A	820	665
	Class B	665	540
600	Class A	1160	950
	Class B	960	785
900	Class A	1640	1350
	Class B	1360	1120
1500	Class A	2500	2080
	Class B	2100	1745
2500	Class A	3206 psia	3206 psia
	Class B	3150	2625

TABLE P-7

Spec. No.	Grade	Nom. Comp.	Spec. Min. Tensile	Notes
PLATE STEELS				
CARBON STEEL				
SA-129	A		40000	
SA-129	B		44000	
SA-129	C		42000	
LOW-ALLOY STEEL				
SA-337		5Cr-$^1/_2$ Mo	60000	
PIPE & TUBES				
SEAMLESS ALLOY STEEL				
SA-250	T1	C-$^1/_2$ Mo	55000	(2)(8)
SA-250	T1a	C-$^1/_2$ Mo	60000	(2)(8)
SA-250	T1b	C-$^1/_2$ Mo	53000	(2)(8)

NOTES TO TABLE P-15:

[1] Adjusted pressure ratings for steam service at saturation temperature corresponding to the pressure.

[2] Pressures shown include the factor for boiler feed and blowoff line service required by Pars. P-299(d) and P-310(c).

[3] Class A includes welding ends, ring joints, small tongue-and-groove facing with any type gasket, large tongue-and-groove with any type gasket except flat solid metal, and other facings with gaskets which result in no increase in bolt load or flange moment over those previously mentioned.

Class B includes standard raised face and all other facings not specifically included under Class A.

PAR. P-27(f) Change all references to "ASA B16e-1939" and "ASA B16e6-1949" to read "ASA B16.5-1953."

PAR. P-180(c) Delete the last sentence of the second paragraph.

Replace the last paragraph with the following:

Inside backing strips when used at longitudinal welded joints shall be removed and the weld surface prepared in accordance with Par. P-102(h)(2)(a). Inside backing rings may remain at circumferential welded seams of headers provided such construction complies with the requirements of Par. P-112.

Add the following as a CAUTIONARY NOTE:

For constructions operating in the range where creep and stress rupture strength govern the selection of stresses, it is desirable to remove all weld reinforcement.

PAR. P-102(h)(2) Revise the paragraph designation to read (2)(a). Designate second paragraph of present Par. P-102(h)(2) as (2)(b). Revise the new (h)(2)(b) by inserting phrase "except as restricted by Par. P-180(c)" after reference to Par. P-101(d)(5) in the third line.

Unfired Pressure Vessels, 1952

PAR. UW-11(a) Add the following at the end of the paragraph: "(See Par. UW-52 for spot examination.)"

PARS. UG-34(1), UCS-8(b), UCS-9(b), UA-6(b)(1), AND (b)(2) Change references to "ASA B16e-1939" and "ASA B16e6-1949" to read "ASA B16.5-1953."

TABLE UCS-23 Add and revise specifications as given elsewhere on this page. Change Note (1) to read: "(1) See Par. UCS-6(b)."

Change the following grade designations in the table and in note (14) to the new designations given:

SA-213: Grade T13 to read Grade T5b; Grade T14 to read Grade T3b; Grade T16 to read Grade T5c.

SA-335: Grade P3a to read Grade P3; Grade P5a to read Grade P5; Grade P16 to read Grade P7; and Grade P17 to read Grade P9.

SA-182: Grade F2 to read Grade F12; and Grade F17 to read Grade F9.

Delete SA-193 Grades BA, BB, and BC, from the table.

Add the following to note (14):

		For Metal Temperatures Not Exceeding Deg F			
Spec.	No. Grade	—20 to 400	500	600	650
SA-336	F2	17500	17500	17500	16800
SA-336	F5	20000	19200	18000	17300
SA-357	..	15000	14500	14000	13700

Add the following notes:

(15) For temperatures below 400 F, stress values equal to 20% of the specified minimum tensile strength will be permitted.

(16) See Par. UCS-67(d).

(17) See special ruling in regard to welding with electrodes having a tensile strength less than the base material.

TABLE UCS-27 Delete SA-83.

Change Note (3) to read: "Only (silicon) killed steel shall be used above 900 F."

TABLE UHA-23 Add "(9)" for SA-268, Grade TP430 in the Notes column, for both Welded and Seamless Pipe and Tubes.

Under Bolting, add SA-193, Grade B8F, Type 303, Nominal Composition 18 Cr-8Ni, Specified Minimum Tensile Strength 75,000, Notes (5) and (7), with maximum allowable stress value of 15,000 for —20 to 100 F.

Under Bolting, add eight grades of SA-320, with Notes (5), (7), and (8).

Delete the type numbers and change the following grade designations for grades of SA-182 as given:

Grade F8 to read Grade F304; Grade F8t to read Grade F321; Grade F8c to read Grade F347; Grade F8m to read Grade F316; and Grade F25 to read Grade F310.

Delete the four grades of SA-158 under Pipes & Tubes, Seamless.

Delete SA-157 Grades C6 and C9a.

Add "(9)" under "Notes" column for SA-240.

Add SA-320 (eight grades) under "Bolting," with "(5), (7), (8)" under "Notes."

Add the following notes:

(8) For temperatures below 100 F, stress values equal to 20% of the specified minimum tensile strength will be permitted.

(9) This steel may be expected to develop embrittlement at room temperature after service at temperatures above 800 F; consequently its use at higher temperatures is not recommended unless due caution is observed.

TABLE UCS-23

Mat'l & Spec. No.	Grade	Nom. Comp.	Spec. Min. Tensile	Notes	For Metal Temperatures Not Exceeding Deg F: —20 to 650	700	750	800	850	900	950	1000	1050	1100	1150	1200
PLATES																
CARBON STEELS																
SA-201	A ..	..	..	..	..	..	..	..	..	..	4500	..	..	..	..	..
SA-129	A ..	..	40000	..	10000	..	..	..	..	..	..	..	..	..	..	..
SA-129	B ..	..	44000	..	11000	..	..	..	..	..	..	..	..	..	..	..
SA-129	C ..	..	42000	..	10500	..	..	..	..	..	..	..	..	..	..	..
LOW-ALLOY STEELS																
SA-353	..	.9 Ni	90000	(17)	22500	..	..	..	..	..	..	..	..	..	..	..
SA-357	..	5 Cr-½ Mo	60000	(14)	..	13400	13100	12800	12400	11500	10000	7300	5200	3300	2200	1500

MAXIMUM ALLOWABLE STRESS VALUES FOR FERROUS MATERIALS, POUNDS PER SQUARE INCH

—20 to 100	200	300	—20 to 400	500	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300
			10000	10000	10000	10000													
			11000	11000	11000	11000													
			10500	10500	10500	10500													
			15000	14500	14000	13700	13400	13100	12800	12400	11500	10000	7300	5200	3300	2200	1500		
			11700	11700	11700	11700	11700	11700	11450	11200	10650	7250	*4700*						
			12750	12750	12750	12750	12750	12750	12250	11700	10650	7250	*4700*						
			11250	11250	11250	11250	11250	11250	11050	10850	10650	7250	*4700*						

ASME NEWS

With Notes on the Engineering Profession

Community Progress Through Engineering Is Keynote of 1954 ASME Semi-Annual Meeting

William Penn Hotel, Pittsburgh, Pa., Headquarters, June 20–24. Schedule of Technical Sessions and Inspection Trips Will Complete an Extensive Program

COMMUNITY Progress—A Challenge to the Engineer—is the theme of the 1954 ASME Semi-Annual Meeting which will be held at the William Penn Hotel, Pittsburgh, Pa., June 20–24.

It is entirely appropriate that a meeting of mechanical engineers should be held in Pittsburgh—city of industrial miracles—which reflects so many achievements by men engaged in this profession. Some of the many "world's largests" which Pittsburgh claims are: Tinplate-producing unit; by-product coke plant; manufacturers of aluminum, air brakes, steel rolls, plate and window glass, rolling-mill machinery, bolts, nuts, and rivets; wrought-iron pipe, refractories, safety equipment, and plumbing fixtures; food-products company, operating unit in the steelmaking industry; wire-manufacturing plant; producer of bituminous coal; and commercial coal producer. Here also is located the second largest electrical equipment company.

A wealth of technical material is being prepared for presentation in the more than 40 technical sessions scheduled so far. Social functions, serving as a foil for the more serious business of the meeting, are planned. Inspection trips to the local heavy industries have been arranged and presently include: Fisher Body Division of General Motors Corporation; Elrama Station, Duquesne Power and Light Company; Jones and Laughlin Steel Corporation; Gulf Research Laboratories, Harmarville, Pa.; Westinghouse Electric Corporation, Aluminum Company of America; Mine Safety Appliances; and Rockwell Manufacturing Company.

Aerial view of Pittsburgh, Pa., showing The Golden Triangle. The 1954 ASME Semi-Annual Meeting will be held at the William Penn Hotel, June 20–24.

Technical Program

A preview of the technical-sessions program reveals such interesting topics as heavy aluminum forgings and extrusions; high-speed electric heating for large steel sections; the design and performance of gears; powdered and sintered metals; the properties, processes, and fabrication of titanium; regulating systems for rolling-mill drives; and controls for steel-annealing lines. Among other papers of merit which will be presented on the program are two on stress criteria for nuclear-power plants and problems encountered in sodium-cooling nuclear reactors for submarines. In addition to these papers, others will be sponsored by the Fuels, Gas Turbine Power, Instruments and Regulators, Management, Materials Handling, Power, Process Industries, Rubber and Plastics Divisions, the Lubrication Activity, and the National Junior Committee.

Social High Lights

The social affairs of the meeting will be launched with a reception on Sunday evening, June 20, for those who register early. The President's luncheon on Monday will be the second event on the social calendar. Monday evening has been purposely left open so that members and their guests may have an opportunity to shop in various Pittsburgh department stores, visit the exhibit of Medieval Armor at the Carnegie Art Institute, Library, or Museum; ride the unique inclines, attend the outdoor Civic Light Opera performance at the University of Pittsburgh Stadium; or visit the sky show at the Buhl Planetarium

Gulf Research & Development Company, Harmarville, Pa., is on the list of plants to be seen during the 1954 ASME Semi-Annual Meeting

Tuesday evening Raymond R. Tucker, Mem. ASME, Mayor of St. Louis, Mo., will deliver the Roy V. Wright Lecture. Outstanding of the social events will be the banquet on Wednesday evening which will be preceded by a reception for all those attending the meeting. A. B. Van Buskirk of P. T. Mellon and Sons, will give the banquet address. His talk will be one of the many features of the meeting which will tend to develop the theme, "Community Progress—A Challenge to the Engineer."

Women's Program

A splendid program is being drafted for the women who will be in Pittsburgh for the meeting. The program, while not complete as yet, is highlighted by several parties, a boat trip, sight-seeing trips in and around Pittsburgh, informal bridge tournaments; and inspection trips to the H. J. Heinz plant and a "plush" luncheon party to be held at the Westinghouse-Jones & Laughlin executive dining room, located on the twenty-fourth floor of the new and fabulous Gateway Center.

Pittsburgh Renaissance

What Pittsburghers like to call a "renaissance" was begun shortly after World War II. Today industry, business, political, and civic leaders are working together to complete a $1½-billion rebuilding of the city. The Golden Triangle, the city's main business district, which was being tarnished by the ever-present smoke and saddled with a continuous fight against floods and stream pollution, is the site of an $8 million park and five-level underground parking garage. A 36-acre park and historic shrine will revitalize the Point of the Golden Triangle, at the juncture of the Allegheny and Monongahela Rivers and beginning of the Ohio.

The plans of many Pittsburgh companies to move to other parts of the country threatened the city's economic survival. The first project of the renaissance was the flood and smoke-abatement program, which resulted in a network of seven dams and reservoirs to regulate flow from the watershed into the two rivers that bout the triangle. The last of these dams, the Conemaugh Dam, was placed in operation November, 1953. Along with the other six flood-control projects, the Conemaugh will lop about 10.5 ft from any crest in downtown Pittsburgh.

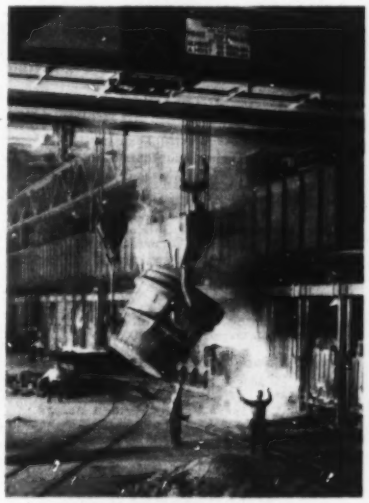
As a result of the smoke-abatement efforts to date, Pittsburgh in the past four years has had 65 per cent more sunshine. Of the many improvements, this fact brings the most frequent comments from visitors who knew Pittsburgh before.

Conquests of the floods and smoke sparked a new spirit—one that inspires change rather than accepts the seemingly inevitable—and this has been translated into action with the demolition of scores of buildings for new facilities in the downtown area. Notable among these projects is the Point Park project, where 36 acres had to be cleared. Among the tenants who had to find new quarters elsewhere was the Pennsylvania Railroad. The Equitable Life Assurance Society of the United States has announced plans for eight skyscrapers on the site which has been named Gateway Center, symbolic of Pittsburgh's historic position as the Gateway to the West. Three of the buildings have been completed.

Uptown, almost simultaneously, have risen two other skyscrapers which assure Pittsburgh's position as the steel and aluminum capital of the world. The 31-story Aluminum Company of America building, faced entirely in aluminum, is a departure in construction. A block away is the new United States Steel-Mellon skyscraper.

The new Greater Pittsburgh Airport was opened in June, 1952, and is second in size only to Idlewild Field in the New York area. The terminal building includes about every conceivable convenience, including a 62-room hotel, motion-picture theatre, and a night club.

Ever since the renaissance began, the old-established firms, newcomers, and allied industries have all added to Pittsburgh's rebuilding. However, industry and commerce are not alone in enjoying this revitalization; The University of Pittsburgh, Duquesne University, and Carnegie Institute of Technology are in there, building with the best of them.



Plant trips include viewing of No. 4 Open-Hearth Shop Charging Floor scene at Jones & Laughlin Steel Corporation's Pittsburgh, Pa., Works. A giant ladle is shown charging molten iron into one of the 11 furnaces of the shop.

New Journals of General Interest Published

Several new publications have been brought to our attention which we feel would be of general interest to the members of the Society. Included among these new contributions in the literary field of engineering and allied endeavors are: *The Chartered Mechanical Engineer*, *The Journal of the ISA*, *Industrial Design*, and *The Magazine of Standards*.

The Chartered Mechanical Engineer, which will supersede the existing *Journal* of The Institution of Mechanical Engineers, will contain in addition to the news of the Institution a high proportion of technical information. It will be published monthly except in July and August. Summaries of papers accepted for publication will appear in *The Chartered Mechanical Engineer* some four to eight weeks in advance of meetings at which full papers will be presented.

The new *Journal of the ISA*, which has been appearing as a section in *Instruments* for several years, is planned as an expansion of service of The Instrument Society of America to its members, to the industrial and scientific makers and users of instruments, and to the technical public. The Journal will be published monthly and the subscription rate is $5 a year or 75 cents a copy.

Industrial Design, first issue, February, 1954, is designed to explore the problems and report the information needed by the designers who throughout industry are concerned with prod-

uct design, development, and marketing directly reflecting the public's needs.

This is a bimonthly review of form and technique and subscription price is $9 for one year, $16 for two years in the U. S., U. S. Possessions, Canada, and the countries of the Pan-American Union; rates for other countries, $11 for one year. Price for a single copy is $2.

The American Standards Association monthly magazine, *Standardization*, began publication under a new name with the January, 1954, issue. It is now called *The Magazine of Standards*. It will seek broadened coverage in the field of standards, nationally and internationally. Long published primarily as a service to ASA's membership, the magazine is offering subscriptions to the public for the first time in a drive to increase circulation.

A monthly series is scheduled on government standards. S. P. Kaidanovsky is the author and the series records continous major developments on standards, specifications, item identification, inspection, and testing at all government levels.

ASME Region VIII to Hold Fifth Annual Meeting in Tulsa, Okla.

Mayo Hotel Headquarters, April 25–28; ASME Region VIII, ASME Boiler Code Committee Meetings, and ASME Student Conference Programs Bid Large Audience

Region VIII of The American Society of Mechanical Engineers, comprising the following sections: Mid-Continent, Rocky Mountain, New Mexico, Kansas City, North and South Texas, New Orleans, and Mexico, will hold its Fifth Annual Meeting at the Mayo Hotel, Tulsa, Okla., April 25 through 28. The ASME Boiler Code Committee will hold its meeting at the same time. Registration starts Sunday, April 25, at 5:00 p.m. During this same period the Student Conference will be in session to select the prize-winning papers by students from the Universities of Oklahoma, Arkansas, Kansas, Nebraska, and Kansas State College, and Oklahoma A&M College.

All the technical sessions and social functions will be held in the Mayo Hotel, except the Monday Luncheon, which will be in the Chamber of Commerce Building. The Student Conference technical sessions will be held at the Public Service Company of Oklahoma Building; social functions at the Mayo Hotel.

The Combined Program

MONDAY, APRIL 26

8:00 a.m.
Authors' Breakfast, Mayo Hotel

8:30 a.m.
Registration, Mayo Hotel

Technical Session

Chairman—Wayne Moody, Sunray Oil Corp.
Vice-Chairman—Allan Hardy, W. C. Norris Manufacturing Co.

9:00 a.m.
Speaker: *Ted C. Anderson*, Jones & Laughlin Steel Corporation, Lyons, Kan.
Subject: **Electrical Oil-Well Pumping With Flexibility**

9:50 a.m.
Speaker: *C. L. Graves*, J. Ray McDermott & Co., Harvey, La.
Subject: **Construction of Biggest Mississippi River Pipe-Line Crossing**

10:40 a.m.
Speaker: *James Woodburn*, Rice Institute, Houston, Texas
Subject: **Five-Year Engineering Program**

12:00 noon
Luncheon with The Engineers Club of Tulsa,
Address of Welcome: Mayor of Tulsa
Speakers: Chairman of Boiler Code Committee, *H. B. Oatley*, Vice-President of Region VIII, *C. H. Shumaker*
Toastmaster: W. R. Clarke, Forth Annual Meeting Region VIII, general chairman, Jones & Laughlin Steel Corp., Supply Division

Technical Session

Chairman—R. C. Paddock, University of Arkansas
Vice-Chairman—Bill Forney, National Tank Co.

2:00 p.m.
Speaker: *Stephen J. Juhasz*, Midwest Research Institute, Kansas City, Mo.
Subject: **Hydraulic Analog for Solution of Heat-Exchanger Problems**

3:15 p.m.
Speaker: *J. R. Bruggeman*, Bureau of Reclamation, Denver, Colo.
Subject: **Recent Development in Engineering Computations**

4:10 p.m.
Speaker: *William J. Graff*, Consolidated-Vultee Aircraft Corp., Fort Worth, Texas
Subject: **Engineering Problems Encountered in Nuclear Reactors**

2:00 to 5:00 p.m.
Meeting of ASME Boiler Code Subcommittees: Unfired Pressure Vessel Subcommittee, Section VIII, H. C. Boardman, Chairman
Subcommittee on Welding, C. W. Wheatley, Chairman
Subcommittee on Opening and Bolted Flange Connections, P. S. C. Williams, Chairman

5:30 to 6:30 p.m.—Social Hour

7:00 p.m.—Banquet—Ivory Room, Mayo Hotel
Speaker: *C. V. Elwell*, The Western Co., Midland, Texas
Subject: **Engineers Versus Human Beings**
Entertainment: Louie Freeman—"Oklahoma Rural Philosopher"

TUESDAY, APRIL 27

Panel Session

9:00 to 12:00 noon
Subject: **ASME Unfired Pressure-Vessel Code Section VIII, 1952 Edition**
Panel Members: *H. C. Boardman*, Chicago Bridge & Iron Co.
C. E. Rawlins, Phillips Petroleum Company
E. C. Korten, Hartford Steam Boiler Inspection & Insurance Co.
George Fratcher, A. O. Smith Corporation
Walter Somans, Philadelphia, Pennsylvania
F. X. Gilg, The Babcock & Wilcox Company
W. P. Gerhart, Bethlehem Steel Company
E. O. Bergman, C. F. Braun & Company
F. S. G. Williams, Taylor Forge & Pipe Works
N. Jesson, The Babcock & Wilcox Company
C. O. Myers, National Board of Boiler & Pressure Vessel Inspectors
All ASME Members and interested public are invited.

12:00 noon—Luncheon—Presentation of Awards for Student Papers

1:30 to 3:30 p.m.—Inspection Trips
American Airlines Shops
Stanolind Research Laboratories
Douglas Aircraft Company

4:00 to 6:00 p.m.
Cocktail Party—ASME Boiler Code Committee will be hosts. All registrants and wives invited.

WEDNESDAY, APRIL 28

9:00 to 11:45 a.m.
Meeting of ASME Boiler and Pressure-Vessel Code Committee. All registrants are invited

2:00 to 4:00 p.m.
Continuation of morning meeting

Arrangements Committee

The Arrangements Committee for the Region VIII Meeting includes the following: W. R. Clarke, General Chairman; Jim Graves, Secretary; R. E. Venn, Technical Papers; Duane Marquis, Hotel; Dick Turner, Registration; Bill Binger, Entertainment; Bennett Howell, Inspection Trips; Jim Wilson, Publicity; Carl Stevens, Finance; Bill Ledgerwood, Student Program; and Mrs. Daisye Howell, Women's Program.

1955 ASME Mechanical Catalog

The editors of Mechanical Catalog are expanding and improving the directory section to make it of even greater service to you—of even greater value to manufacturers of products used and bought by mechanical engineers in industry.

Listing guides have been sent to 4300 companies to enable them to conveniently check off products they wish listed in this valuable reference book. No doubt your company has received one of the guides. If it has not been returned to us, you'll do your company and the Society a great favor by expediting its return. If your company has not received a free product-listing guide, let us know and we will forward one immediately. By all means, be sure your company's products are listed in the directory section of the 1955 MC.

Accuracy of Measurements in Engineering Workshops

Industry will be given an opportunity to determine the degree of accuracy of measurements made in engineering workshops.

The Engineering Metrology Section of the National Bureau of Standards is to measure three iron castings having external and internal lengths of approximately 30, 50, and 80 in.

ASME Membership as of Feb. 26, 1954

Honorary Members	52
Fellows	385
Members	14,113
Affiliates	337
Associate Members (33 and over)	3,322
Associate Members (30–32)	1,974
Associate Members (to the age age of 29)	19,183
Total	39,366

These castings will then be made available to industrial plants, which are to measure them by the means and methods they regularly apply.

Emphasis of the investigation will be on large work-pieces. Fourteen firms have indicated willingness to measure these pieces, and any others willing to participate are urged to contact I. H. Fullmer, National Bureau of Standards, Washington 25, D. C.

Results will be submitted for confidential handling to Mr. Fullmer, who is chairman of the Committee on Measurement of Large Dimensions of the Dimensional Standards and Metrology Division, American Ordnance Association, which is sponsoring the investigation. The committee is working in co-operation with a group from the International Organization for Standardization (ISO).

ASME Calendar of Coming Events

April 25–28
ASME Region VIII annual meeting to be held concurrently with ASME Boiler and Pressure Vessel Code Committee meeting, Tulsa, Okla.

June 14–17
ASME Oil and Gas Power Conference, Hotel Muehlebach, Kansas City, Mo.
(Final date for submitting papers was Feb. 1, 1954)

June 14–18
Second U. S. National Congress of Applied Mechanics, University of Michigan, Ann Arbor, Mich.

June 20–24
ASME Semi-Annual Meeting, William Penn Hotel, Pittsburgh, Pa.
(Final date for submitting papers was Feb. 1, 1954)

Sept. 8–10
ASME Fall Meeting, Hotel Schroeder, Milwaukee, Wis.
(Final date for submitting papers—May 1, 1954)

Sept. 13–24
ASME Instruments and Regulators Division and Instrument Society of America Exhibit and Joint Conference, Commercial Museum and Convention Hall, Philadelphia, Pa.
(Final date for submitting papers—May 1, 1954)

Sept. 26–29
ASME Petroleum-Mechanical Engineering Conference, Statler Hotel, Los Angeles, Calif.
(Final date for submitting papers—May 1, 1954)

Oct. 28–29
ASME-AIME Joint Fuels Conference, William Penn Hotel, Pittsburgh, Pa.
(Final date for submitting papers—June 1, 1954)

Nov. 28–Dec. 3
ASME Annual Meeting, Statler Hotel, New York, N. Y.
(Final date for submitting papers—July 1, 1954)
(For Meetings of Other Societies, see page 384)

ASME President L. K. Sillcox speaks to Washington, D. C., Section on Power and Production. Past-chairmen of the Section were present to greet the President. Top row, *left to right,* Charles E. Berberich, M. X. Wilberding, W. G. Allen, C. C. Vogt, and F. J. Hanrahan. Bottom row, *left to right,* G. A. Vacca, C. E. Greeley, President Sillcox, B. C. Cruickshanks, E. C. Magdeburger, J. Fox.

SAM-ASME Management Division Announce Program for Ninth Annual Time-Study and Methods Conference

Management Authorities to Speak; ASME Fellows to Be Honored; and J. C. Worthy to Be Banquet Speaker

The ninth annual Industrial-Engineering Conference featuring Creative Time Study and Methods of the Society for Advancement of Management and the Management Division of The American Society of Mechanical Engineers will be held at the Statler Hotel in New York, N. Y., April 29–30, 1954.

The theme of the conference will emphasize the creative developments in production methods and in industrial engineering, including automatic production.

The Honorable James C. Worthy, Assistant Secretary of Commerce (Administration), of Washington, D. C., will speak to the banquet guests on "Freedom Within Enterprise." A feature of the Thursday luncheon will be the presentation of certificates to the members of ASME newly elected to the grade of Fellow, by H. R. Kessler, vice-president ASME, Region II.

A program has been arranged for the women attending the conference, by the Woman's Auxiliary of the ASME Metropolitan Section, which includes among other points of interest, the Lever Building and the United Nations.

The program follows:

Wednesday, April 28

6:00 p.m. Registration, Foyer, Grand Ballroom

8:00 p.m. Get-Acquainted Party, Cocktails, Grand Ballroom

Thursday, April 29

8:00 Registration, Foyer, Grand Ballroom. Sessions will be held concurrently in the Grand Ballroom and the Georgian Room

9:00 Conference Keynote—Grand Ballroom and Georgian Room

Conference Chairman, Paul J. MacCutcheon, Manufacturing Services Division, General Electric Co., Schenectady, N. Y.

Thursday Morning Sessions
Grand Ballroom

Creative Selection and Training of Industrial Engineers, Chairman, V. Donald Schoeller, lecturer in management, Wharton School, University of Pennsylvania

9:15 Selection of Industrial-Engineering Personnel, *Charles A. Thomas,* Manager of Industrial Relations and Industrial Engineering, Standard Pressed Steel Co., Jenkintown, Pa.

10:10 Training of Industrial-Engineering Personnel, *Nicholas A. Maricucci,* management consultant, Hillside, N. J.

11:00 Full discussion of both topics

Georgian Room

Creative Approaches to Materials Handling, Chairman, Donald W. Pennock, factory engineer, Carrier Corporation, Syracuse, N. Y.

9:15 Tomorrow's Materials-Handling Methods, Introduction, *Matthew J. Murphy,* editor, *Factory Management and Maintenance,* New York, N. Y.

9:30 Factors That Influence Today's Materials-Handling Methods, *R. S. Rice,* industrial-production editor, *Factory Management and Maintenance,* New York, N. Y.

9:50 The 1960 Picture, *Carroll W. Boyce,* special products editor, *Factory Management and Maintenance,* New York, N. Y.

10:20 Discussion period

10:45 **Standard Performance Times for Fork Trucks,** *Oswald S. Carliss,* director of engineering, Yale Materials-Handling Division, The Yale and Towne Manufacturing Co., Philadelphia, Pa.

11:45 Discussion period

Thursday Luncheon

12:30 Chairman, Phil Carroll, professional engineer, Maplewood, N. J.

Presentation of ASME Fellow Awards, Henry R. Kessler, vice-president ASME, Region II

Private Enterprise at Niagara Falls, *Earle J. Machold,* president, Niagara Mohawk Power Corp., Syracuse, N. Y.

Thursday Afternoon

Grand Ballroom

Creative Measurement of Overhead Expense, Chairman, Elles M. Derby, manager, Management-Education Division, Metropolitan Life Insurance Co., New York, N. Y.

2:30 **Measurement of Maintenance Labor,** *John C. Flynn,* methods supervisor, E. I. du Pont de Nemours & Co., Louisville, Ky.

3:25 **Measurement of Office Operations,** *J. Henry Parker,* chief engineer, Rath & Strong, Inc., Boston, Mass.

4:20 Full discussion of both topics

Georgian Room

Creative Application of Predetermined Time Standards, Chairman, Bruno A. Moski, director of industrial engineering, Yale Material-Handling Division, The Yale & Towne Manufacturing Co., Philadelphia, Pa.

2:30 **Predetermined Time Standards in the Needle-Trades Industry,** *Lea Terrussi,* industrial engineer, LaResista Corset Co., Bridgeport, Conn.

3:25 **Predetermined Time Standards in Fabrication and Assembly Operations,** *Helmut C. Geppinger,* supervisor, motion and time-study training, Bridgeport Plant, General Electric Co., Bridgeport, Conn.

4:20 Full discussion of both topics

Thursday Dinner Session

7:00 Chairman, Bruce Payne president, Bruce Payne & Associates, Inc., Westport, Conn; National President, SAM

Freedom Within Enterprise The Honorable *James C. Worthy,* Assistant Secretary of Commerce, Administration, Washington, D. C.

Friday, April 30

8:00 Registration, Foyer, Grand Ballroom. Sessions will be held concurrently in the Grand Ballroom and the Georgian Room.

Grand Ballroom

Creative Analysis of Wage-Incentive Plans, Chairman, Harry M. Kaiser, department manager, Management Staff, Tire Division, U. S. Rubber Co., New York, N. Y.

9:15 **Auditing of Wage-Incentive Plans,** *Dennett F. Howe,* director of industrial engineering, The Procter and Gamble Company, Cincinnati, Ohio

10:10 **Cost Reduction Through Industrial Engineering Including Wage-Incentive Plans,** *Garland C. Martin,* manager of industrial engineering, Ensign-Bickford Co., Simsbury, Conn.

11:00 Full discussion of both topics

Georgian Room

Creative Advances in Methods Techniques, Chairman, Ercole Rosa, Jr., assistant professor of management, Hofstra College, Hempstead, L.I.

9:15 **Automation—Advances in Automatic Production,** *Robert T. Collins,* general sales manager, New Departure Division, General Motors Corp., Bristol, Conn.

10:10 **Necessity for Quantifying,** *Mel Hurni,* consultant, Management-Consultation Services Division, General Electric Co., New York, N. Y.

11:00 Full discussion of both topics

Friday Luncheon

Chairman, Hugh A. Bogle, supervisor, Planning and Measurement, Maintenance-Engineering Section, E. I. du Pont de Nemours & Co., Wilmington, Del.

To be announced. W. L. McGrath, president, The Williamson Heater Company, Cincinnati, Ohio

J. P. Den Hartog, *left,* chats with W. A. Pearl. Professor Den Hartog, Fellow ASME, of Massachusetts Institute of Technology, spoke before the ASME Oregon Section on vibration. While in Portland he discussed the Bonneville Power Administration, with W. A. Pearl, Mem. ASME, the new BPA Administrator.

Friday Afternoon

Grand Ballroom

Are Wage Incentives Really Worth While? Chairman, Fredrick W. Hornbruch, Jr., chief engineer, Rath & Strong, Inc., Boston Mass.

2:30 **Productivity Without Wage Incentives,** *Robert Pomeranz,* president, The Roberts Company, Sanford, N. C.

3:25 **Productivity With Wage Incentives,** *Robert Jones,* manager of manufacturing, Jones & Lamson Machine Co., Springfield, Vt.

4:20 Full discussion of both topics

Georgian Room

Creative Company—Union Relations, Chairman, William R. Swett, Bruce Payne & Associates, Inc., Westport, Conn.

2:30 **The Industrial Engineer and Labor Contract Clauses,** *G. Jay Anyon,* Wharton School, University of Pennsylvania

3:25 **Creative Arbitration,** *Rev. Dennis J. Comey,* S. J., director, Institute of Industrial Relations, St. Joseph's College, Philadelphia, Pa.

4:20 Full discussion of both topics

5:00 Cocktails, Foyer, Grand Ballroom

F. S. Blackall, jr., past-president ASME, and president-treasurer, The Taft-Peirce Manufacturing Company, Woonsocket, R. I., addresses the Akron Section on European Influence on American Industry. At *left* is E. S. Theiss, past-vice-president, ASME Region V.

Meetings of Other Societies

April 21–23

Southern Industrial Wastes Conference (air and water pollution), Shamrock Hotel, Houston, Texas

April 22–23

American Institute of Electrical Engineers, feedback-control conference, Claridge Hotel, Atlantic City, N. J.

April 26–28

Canadian Institute of Mining and Metallurgy, annual meeting, Mount Royal Hotel, Montreal, P. Q., Can.

April 26–30

American Society of Tool Engineers, tenth biennial industrial exposition, Convention Center, Philadelphia, Pa.

May 3–5

American Mining Congress, coal convention, Netherlands Plaza Hotel, Cincinnati, Ohio

May 3–5

Association of Iron and Steel Engineers, spring conference, Bellevue-Stratford Hotel, Philadelphia, Pa.

May 3–6

Air Pollution Control Association, 47th annual meeting, Patten Hotel, Chattanooga, Tenn.

May 3–8

National Institute of Coal Industry (Belgium), international conference on complete gasification of coal, during sixth International Fair of Liege, April 24–May 9

May 4–8

American Welding Society, national spring technical meeting and exposition, Statler Hotel, Buffalo, N. Y.

May 5–7

International Aviation Trade Show, 71st Regiment Armory, New York, N. Y.

May 7–8

Pennsylvania Society of Professional Engineers, annual convention, Bedford Springs Hotel, Bedford, Pa.

May 8–14

American Foundrymen's Society, annual foundry congress and show, Cleveland Auditorium, Cleveland, Ohio

May 12–22

International Conference on Large Electric Systems (CIGRE), fifteenth session, Paris, France

(*ASME Calendar of Coming Events, see page 383*)

How ASME Cleveland Section Developed and Improved Member Participation

Varied Technical and General Discussion Groups Formed the Basis of Over-All Plan

DURING the operating year 1947–1948, the Executive Committee of the Cleveland Section of The American Society of Mechanical Engineers, in an attempt to bolster the activities of the Section, undertook a vigorous policy-expanding publicity and membership-development program coupled with an exceptionally ambitious schedule for the monthly meetings. The meetings are designed to attract attention of different professional groups with coffee speakers at dinners discussing subjects of general interest.

Member-Interest Survey

The Membership Development Committee, giving several choices, made a survey of all members as to their interests by preference. When, at the end of the year, stock was taken of the results of the year's work, it looked at first as though all the efforts were of no avail as the attendance of the monthly meetings was poor for the size of the Section. However, when the results of the Membership Development Interest Survey were compared with the attendance at the meetings with corresponding subjects, close correlation was noted, indicating that members came only to those meetings in which they were specifically interested.

An analysis of these results and a study of general membership activity showed that improved programming could be developed to serve the direct interests of a much wider group of members. It seemed that the real everyday benefits of membership could be brought closer to the men by offering programs of practical value in many areas simultaneously.

The afore-mentioned data and experiences were passed to the incoming Executive Committee for the year 1948–1949, and it was during that year that it was decided to try a new type of meeting based on divisional interests.

Informal Meetings Introduced

This new type of meeting, in so far as possible, was to be an informal affair with a speaker well versed in his subject. Talks would include a ten to 15 minute introduction, after which, with the chairman of the group acting as moderator, the meeting would be open to discussion. This type of group was to be built around a nucleus of ten to 15 regularly attending members, with total attendance not to exceed more than 30 or 40.

The first attempt was in machine design as there was an active group in this field. Meetings were set up under the title Machine-Design Discussion Group. The success of this experiment encouraged setting up of other discussion groups as shown in Fig. 1.

It was necessary to exercise caution in selecting both the fields in which the groups were set up and in selection of chairmen as they were largely responsible for the subjects and success of the meetings.

What these types of meetings do to the over-all participation of the members is shown in Fig. 2. No doubt, some members attended more than one meeting a month, but they are exceptions, so the growth of attendance is definitely a measure of success of the program.

During the year 1952–1953, when the Railway Discussion Group was started, the procedure was varied by first calling a meeting of top mechanical people of those railroads with headquarters in Cleveland and on their suggestions the meetings were scheduled for the second Monday of each month from 12:00 to 2:00 p.m. This arrangement fits the peculiarities of the industry where people have to spend a large percentage of their time traveling. The time of the meeting as well as the backing of management made this group a success. The timing of this meeting is as follows: Luncheon served—12:00 to 12:30; talk —12:30 to 1:15; and discussion—1:15 to 2:00. This particular group is so active that, on occasion, it attracts more people than general monthly meetings.

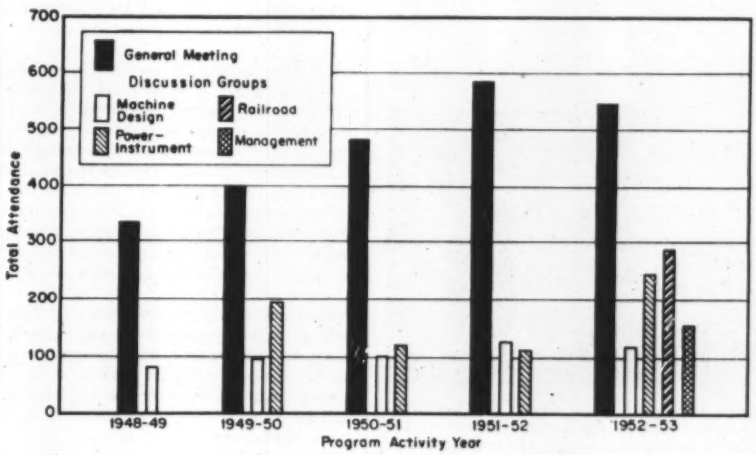


Fig. 1 ASME Cleveland Section development of discussion groups results in increased member activity

Discussion-Group Guide Available

To help others benefit from the experience of the Cleveland Section, a guide was prepared by the Subcommittee on Division-Section Co-Operation of the Professional Divisions Committee entitled," Tentative Guide for Organization of Divisional Interest Discussion Groups as Part of a Section's Activities," which is available from ASME Headquarters in New York, N. Y.

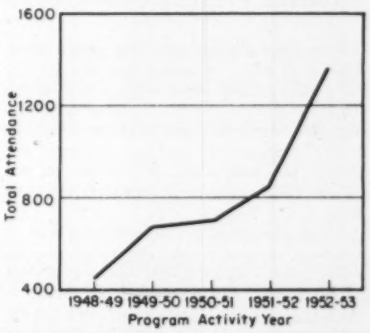


Fig. 2 Cleveland discussion-group programming shows marked increase in total yearly attendance

It is pointed out that this type of meeting need not be restricted to divisional interest. In sections where members are scattered, small groups could meet to conduct their monthly meetings on this basis. This would achieve the results that, under other circumstances, could not be accomplished so successfully by holding only formal monthly section meetings.

Section-Meeting-Topic Suggestions

The following current meeting topics of the Cleveland Section are examples of the type of monthly programs a section can develop:

General Meetings

Oct. 8, Get-Together; Nov. 12, Joint meeting with Purchasing Agents Association of Cleveland on Engineered Purchasing; December, no Section meeting scheduled because of the ASME Annual Meeting; Jan. 14, Industrial application of radioactive materials; Feb. 11, Development and future of the helicopter;

March 11, Joint meeting with Student Branches of Fenn College and Case Institute of Technology—Annual student-paper competition for Cleveland Section Awards; April 8, Inspection trip to Ford Engine Plant; and May 13, Annual ASME President's Dinner.

Discussion Groups

Machine Design: (1) Plant tour, Aluminum Company of America; (2) Economical design for small lots; (3) Hydraulic-pressure seals between relative-motion parts; (4) Designing parts for induction heating; (5) Clutch application in machine design; (6) Equipment used for solution of commercial vibration problems; and (7) Cost engineering.

Management: (1) Organization of an engineering department for effective action; (2) Job classification and salary scheduling for engineers; (3) Budgeting and scheduling engineering projects; (4) Recruiting and training technical graduates; (5) Writing of engineering reports; (6) Patents and original ideas and how they affect engineering work; and (7) Human relations and how they affect department productivity.

Power and Instruments: (1) Electronic calculating machines; (2) Income-tax deductions; (3) Transducers for process instrumentation; (4) Recent developments in diesel-power engineering; (5) Automatic-load control for electric systems; and (6) Tour of C.E.I. Eastlake Power Plant.

Railroading: (1) Visit to new technical center of National Malleable & Steel Castings Company; (2) Progress of the coal-burning gas turbine; (3) Future of the freight-car roller bearing; (4) Failures of railroad freight-car bodies; (5) Diesel-locomotive electric-drive failures; (6) Torque-converter design for diesel locomotives; (7) Trailer loading on railroad freight cars; and (8) Railroad lubricants.

Five Cincinnati Sections of National Engineering Societies Sponsor Professional-Development Program

Five major engineering society groups of the Cincinnati, Ohio, industrial area met recently for a joint professional-development program. This was the first step in a concerted action on the part of the five societies relative to the ECPD Professional Training program for young graduate engineers, known as the "First Five Years of Professional Development."

Local sections of the American Institute of Chemical Engineers, the American Institute of Electrical Engineers, The American Society of Mechanical Engineers, and the American Society of Civil Engineers joined with the Engineering Society of Cincinnati in staging the program.

The keynote speaker was Sidney D. Kirkpatrick, past-president of AIChE, vice-president and editorial director of the McGraw-Hill Book Company. Mr. Kirkpatrick, who has an outstanding record of leadership in the field of professional development for young men, spoke on the theme "At the Threshold of an Engineering Career."

Following the keynote address, the audience was divided into eight discussion groups for round-table sessions relating to the six points of the ECPD program. Subjects discussed included: Orientation and training in industry, continued education, integration into the community, professional registration, self-appraisal, and selected reading.

Each of the five societies participating designated eight key members to assist in leading these group discussions.

At a preliminary dinner meeting, the 40 members of the eight-group panels heard an introductory talk by Harry M. Hopkins, vice-president in charge of operations of the Tool Steel Gear & Pinion Company, on the subject "What Makes a Group Tick."

The 40 society representatives who served in leading the eight different discussion groups represented 32 industries and engineering companies in the Cincinnati area.

This meeting was another in the steps of the ECPD pilot study known as the "Community Project in Professional Development" which is emphasizing the importance of related activities of industry, the engineering societies, and the universities on a community basis in a typical industrial area.

The project is based on two cardinal principles: Industry and the engineering profession must provide the young engineer with a favorable climate in which to grow. The young engineer must realize that the final responsibility for professional advancement rests with him, the individual.

A report on this pilot study will be given at the ECPD annual meeting in Cincinnati next October, and plans are now under way to establish similar projects in industrial areas throughout the United States and Canada.

A part of one of the eight discussion groups in action at the recent Professional-Development Seminar held in Cincinnati, Ohio. Seen at the head of the table are Sidney D. Kirkpatrick, keynote speaker at the joint meeting of the five societies, and Raphael Katzen, representative of the Ohio Valley Section of AIChE, who served as group leader. Harold Wyatt, *extreme right,* ASME representative. Other societies participating are AIChE, ASCE, ASME, and the Engineering Society of Cincinnati.

Heat-Transfer and Fluid-Mechanics Institute, University of California, Berkeley

The seventh annual Heat-Transfer and Fluid-Mechanics Institute will be held at the University of California, Berkeley, on June 30, July 1 and 2, 1954. The Institute was organized to provide a meeting of breadth and quality which would make a definite contribution to the scientific advancement and intellectual growth of the Western community. Meetings of the Institute are held in California to reduce the effect of geographical isolation of engineers and scientists in the West Coast area, and to provide an opportunity for these men to keep abreast of the latest advances in the fields of heat transfer, fluid mechanics, and related subjects. However, the intention of the Institute is to maintain participation on a nationwide basis.

The San Francisco Section of The American Society of Mechanical Engineers is among the five national technical society groups and six educational institutions who join to sponsor this annual event.

The Institute will give consideration to analytical and experimental problems in thermal radiation, conduction, convection, mass transfer, combustion, ideal compressible and incompressible flow of gases and liquids, and the various aspects of pipe, channel, and boundary-layer flow. The three-day program will consist of six sessions of three papers each, or a total of 18 papers. The following titles are merely a partial list of the papers to be presented during the technical program: Thermal network method of radiation analysis, experiments on velocity and temperature fluctuations behind a heated grid, current status of problems of combustion, the formation of gas bubbles at horizontal orifices, time-dependent oscillations of a strong oblique shock, and flow in corners of passages with noncircular cross sections.

All papers will be preprinted in full. Complete sets of preprints will be on sale at the Institute at a cost of $5. Immediately following the Institute, a limited number of sets of preprints will be available for purchase by mail for $5.50.

For further information contact: H. A. Johnson, Division of Mechanical Engineering, 114 Engineering Building, University of California, Berkeley, Calif.

Speakers at the ASME Textile Engineering Conference pause for a chat. ***Left to right,*** **M. J. Goglia, professor, Georgia Institute of Technology; E. J. Keating, Cotton Chemical Finishing Division, U. S. Department of Agriculture, New Orleans, La., Peter Strang, Whitin Machine Works, Atlanta, Ga.; and M. Mayer, U. S. Department of Agriculture, New Orleans, La.**

ASME Textile Engineering Division Conference Accents Need for Engineers

Engineers' Opportunities Described; Progress in Carding, Weaving, and Testing Outlined

THE profitable use of trained engineers in such phases of the textile industry as standards, research, methods, materials handling, quality control, or production was discussed at a conference held by the Textile Engineering Division of The American Society of Mechanical Engineers at the Georgia Institute of Technology, February 5.

Addressing the luncheon meeting, M. E. Heard, Mem. ASME, vice-president, West Point (Ga.) Manufacturing Company, also told of the benefits to be derived by both the engineers and the textile-machinery manufacturers from such Society meetings, which provide a forum where they can acquaint one another with industrial problems to be solved.

The old-style cotton mill was organized so that authority and responsibility extended through one unbroken chain of command from top to bottom, Mr. Heard said, and development and engineering were all done by the production man with the result that both suffered from lack of attention. The modern mill organization relieves the production supervisor of the engineering work, which is handled by specialists who can and should do a better job. "This means that the production men are able to devote more of their time to their real job, which is to get the most work done with the men, material, and machines at their disposal."

Engineers make excellent supervisors and executive material. Because of his training an engineer is equally at home in production, engineering, research, or methods of work. "The engineer," Mr. Heard said "is the only professional man I know who is by training a man who specializes in solving problems."

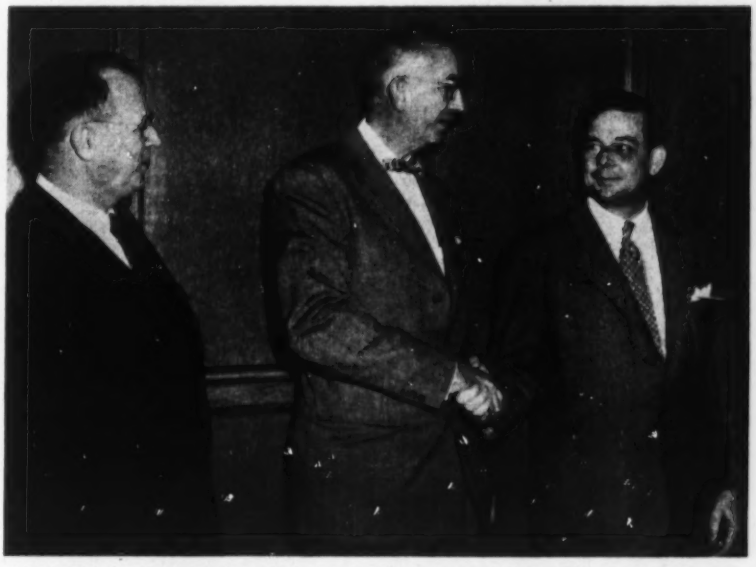
Methods and standards engineering, he went on to say, is devoted to working out better methods and developing more accurate costs and production pictures of the operations so that top management can use these facts in making their decisions. Without these facts furnished by the engineers, management must return to the old method of relying on their own experience or that of others for something on which to base its decisions.

Plant layout and materials handling are of paramount importance in a cotton mill, and good engineering in these fields is a "must."

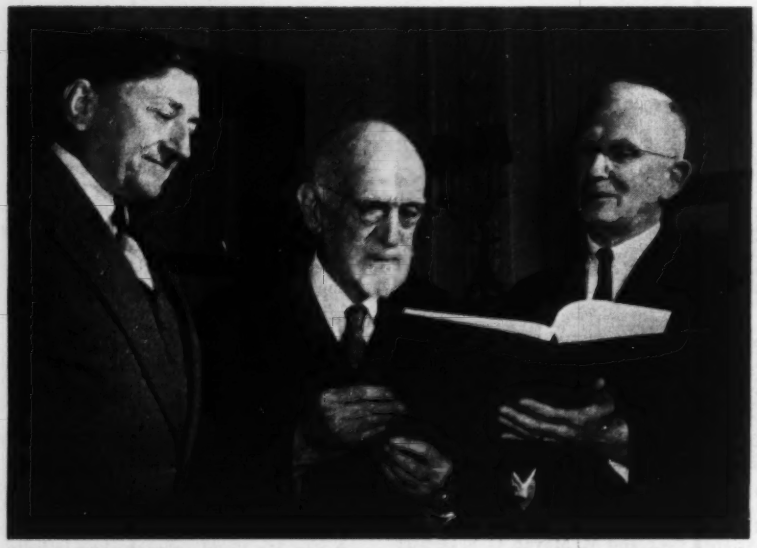
Engineers are playing an important role in the field of standardization, Mr. Heard told the group. A true standards program is a valuable asset to any mill, he emphasized, and standardization pays off, not only in time and money, but equally well in all phases of manufacturing, including fabric design, production, processes, parts, machines, mill construction, air conditioning, and lubrication.

"The textile industry probably lies more clearly in the mechanical-engineering field because mechanical engineering is such a broad field," he concluded.

Besides Mr. Heard, other speakers included Esmond J. Keating of the Cotton Chemical Finishings Division, U. S. Department of Agriculture, who discussed "Some Design Features of a Pilot-Plant Continuous-Yarn or Fabric-Finish Range"; M. Mayer, also of the Department of Agriculture, who spoke on "SRRL Loom Attachment for Weaving Extra-Dense Fabrics"; M. J. Goglia, Mem. ASME, professor of mechanical engineering, Georgia Institute of Technology, who covered "Air Permeability of Parachute Cloth," and Peter M. Strang, Whitin Machine Works, Whitinsville, Mass., who explained "The Theory of Carding." Blake Van Leer, Fellow ASME, G.I.T. president, gave the keynote address.



ASME Textile Engineering Division Conference in Atlanta, discussed important new avenue for mechanical engineers. ***Left to right,*** **P. R. Yopp, vice-president ASME, Region IV, district manager, The Babcock & Wilcox Company, Atlanta, Ga.; M. E. Heard, luncheon speaker; and J. C. Edwards, Mem. ASME, Exposition Cotton Mills, Atlanta, Ga., who presided at the one-day meeting.**



W. F. Durand, pioneer in aeronautical engineering, past-president and Hon. Mem. ASME, celebrated his 95th birthday on March 5, 1954. ASME President L. K. Sillcox, *right,* and Ernest Hartford, deputy secretary, ASME, *left,* present to Dr. Durand a congratulatory birthday book from the San Francisco Section, which he helped start in 1915 and later served as chairman in 1919–1920

People . . .

Vice-Admiral Edward L. Cochrane, USN (ret.) Hon. Mem. ASME, was appointed vice-president for industrial and governmental relations at Massachusetts Institute of Technology. At the same time C. Richard Soderberg, Fellow ASME, head of mechanical engineering at M. I. T. since 1947, was elevated to dean of the school of engineering.

• • •

David S. Jacobus, past-president and Hon. Mem. ASME, in honor of his 65 years of faithful service to ASME and contributions in the field of engineering, was recently presented with a certificate authorized by the Council of the Society. The presentation took place on his 92nd birthday at his home in Montclair, N. J., and was attended by E. G. Bailey, H. V. Coes, F. L. Bradley, W. A. Shoudy, and H. R. Kessler.

• • •

James Hodge, Mem. ASME, and a leading British authority on gas turbines and jet engines, has been appointed visiting lecturer in Columbia University's mechanical-engineering department for the spring semester.

• • •

Scott Turner, consulting mining engineer, New York, N. Y., was re-elected president of The American Institute of Consulting Engineers, at a recent meeting of the Institute. Other elected officers are: Richard E. Dougherty and Francis S. Friel, vice-presidents; Leslie G. Holleran, re-elected secretary; and George C. Diehl, re-elected treasurer.

• • •

Aaron Wachter of Shell Development Company, Emeryville, Calif., was elected 1954–1955 president of the National Association of Corrosion Engineers; F. L. Whitney, Jr., vice-president; and Russell A. Brannon, re-elected treasurer, at the tenth annual NACE conference and exhibition held at the Hotel Muehlbach, Kansas City, Mo., March 15–19.

• • •

Irving A. Denison, Diamond Ordnance Fuze Laboratories, Department of Defense, Washington, D. C., received the Willis Rodney Whitney Award for contribution to corrosion science at the 1954 NACE annual banquet; E. H. Dix, Jr., assistant director of research, Aluminum Research Laboratories, Aluminum Company of America, New Kensington, Pa., received the Frank Newman Speller Award for achievements in corrosion engineering.

• • •

Donald J. Leehey was named manager of the operation center of the Atomic Energy Commission at Santa Fe, N. Mex.

• • •

Promotions of four engineers to high positions in the heat-power department at Armour Research Foundation of Illinois Institute of Technology were announced as follows: Henry E. Robison, Mem. ASME, from research engineer to senior research engineer, highest professional post in the Foundation; Channon F. Price, from assistant supervisor to supervisor of one of the thermodynamics sections; John C. Lee, from assistant supervisor to supervisor of the hydraulic-power equipment section; and John P. Nordhaus, Assoc. Mem. ASME, from assistant supervisor to supervisor of the other thermodynamics section.

• • •

George W. Gaoel, president of Machinery & Supplies Co., Inc., Kansas City, Mo., was installed as 1954 President of Associated Equipment Distributors, at the 35th Annual Meeting held Jan. 31–Feb. 4, New York, N. Y., at the Waldorf-Astoria Hotel.

• • •

James F. Fairman, vice-president, Consolidated Edison Company of New York, and Erich Hausmann, dean emeritus of Brooklyn Polytechnic Institute, Brooklyn; N. Y., were presented with certificates of honor at a testimonial dinner in their honor, March 24. The event was part of the Silver Anniversary of the Kings County Chapter of the New York State Society of Professional Engineers. G. R. Hahn, Mem. ASME, represented the Society on this occasion.

• • •

Willard F. Libby, professor of chemistry in the Institute for Nuclear Studies, University of Chicago, received the first of two Chandler Medals for the University's Bicentennial year of 1954.

• • •

Ralph J. Cordiner, General Electric Company; Richard H. DeMott, SKF Industries, Inc.; and James L. Meyers, Clevite Corporation, received Stevens Honor Award Medallions at the eighty-fourth annual dinner of the Stevens Institute of Technology Alumni Association dinner held February 26 in New York, N. Y. Richard A. Wolff, Mem. ASME, director of Wolff and Munier, New York, N. Y., received the Alumni Award.

• • •

A. O. Schaefer, vice-president, The Midvale Company, Philadelphia, Pa., was recipient of the first annual award by The American Society for Metals at a meeting of the Philadelphia Chapter of the society. The award, in the form of a citation, names Mr. Schaefer as the Delaware Valley Metals Man of the Year.

• • •

M. H. Thornton, who supervises all chemical operations at Midwest Research Institute, became Director for chemical sciences, and Martin Goland, Mem. ASME, in charge of all Institute engineering and physics activities, became Director for engineering sciences, according to a recent announcement.

• • •

W. T. Cavanaugh was recently elected executive secretary of the Engineering Manpower Commission of the Engineers Joint Council.

ASME Elects Fellows

THE American Society of Mechanical Engineers has honored nine of its members by electing them to the grade of Fellow of the Society.

To be qualified as a nominee to the grade of Fellow one must be an engineer with acknowledged engineering attainment, 25 years of active practice in the profession of engineering or teaching of engineering in a school of accepted standing, and a member of the Society for 13 years. Promotion to the grade of Fellow is made only on nomination by five Fellows or members of the Society to the Council, to be approved by Council.

The men whose outstanding contributions to their profession and to the Society were so honored are:

Frank Leo Bradley

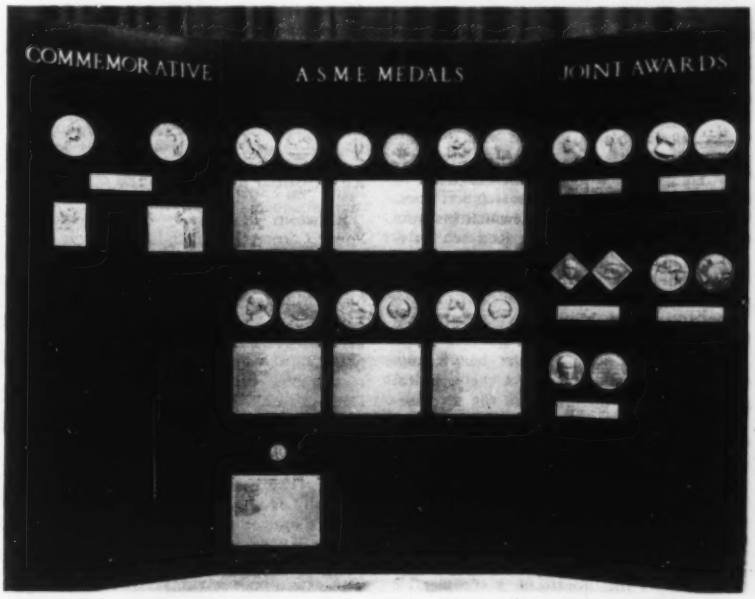
FRANK L. BRADLEY, engineering manager, Forstmann Woolen Company, Passaic, N. J., and vice-president, Garfield Warehouse and Transportation Company, has made outstanding contributions in the power, chemical, and textile fields. He was responsible for engineering and management of both utility and industrial-power projects which included advanced designs developed during the pioneering era of higher steam pressures and temperatures, and larger-capacity units. He supervised the engineering design and co-ordination with construction of mechanical, electrical, and structural work for the nation's greatest synthetic ammonia plant at Hopewell, Va., using pressures up to 3200 psi. Among his many achievements in the textile-manufacturing field are the engineering design, development, and construction of the high-speed worsted-spinning machine to provide 15,000 rpm spindle speeds; and the first continuous indigo-dyeing installation to dye wool "stock" (loose wool fibers in bulk). He was also responsible for research and development of worsted and wool-carding machinery having advanced design features to provide flexibility in wide range of production requirements and increased machinery availability. He has been with the Forstmann Woolen Company since 1931. In his present position he is responsible for engineering and construction of all power facilities, building extensions, and machinery for wool-spinning mill, research laboratory, maintenance machine and carpenter shops, burling and mending building, and power-plant extension. Mr. Bradley has been active in ASME affairs. From 1938 to 1944 he served on the Publications Committee; as chairman, 1942–1944. He is a past-chairman of the Textile Division, 1942–1943; the Power Division, 1952; and the Metropolitan Section, 1952–1953. Since 1948 he has served on the Boiler Code Subcommittee Section. Currently he is a director at large. He has written several papers.

Walter Palmer Gavit

WALTER P. GAVIT, United Engineers & Constructors, Inc., Philadelphia Pa., has been continuously active in the technical development of the power industry. Since 1919 he has been engaged in investigation of various phases of power-station thermodynamics and heat balance. Around 1921 he carried on some original calculations on regenerative feedwater cycles and these far-reaching investigations resulted in the installation of one of the first four-stage regenerative feedwater heating cycles. In addition to this type of work he has done extensive report work on power, steam, and water-supply requirements for utilities and specialized industry. In the steel industry he has participated in extensive reports for leading companies both here and in Canada, including Bethlehem Steel Company, Sparrows Point Plant; Jones & Laughlin Steel Company, Aliquippa Works; Republic Steel Corporation, at Buffalo, Chicago, Cleveland, and Youngstown Works; U. S. Steel Corporation, at the Gary, South, and Youngstown Works; and Youngstown Sheet and Tube Company, Campbell Works. Recently he made an extensive report on the steam and power requirements of the General Electric Company, Schenectady Works. In all these cases his reports and investigations resulted in major power and steam installations at the sites indicated. Mr. Gavit was in charge of design of a complete steam and electric station, Seward Power Station, Seward, Pa.; and a complete power station for the Los Angeles Gas and Electric Corporation, Los Angeles, Calif., and other projects. Accounts of much of his work have been published, either under joint authorship or under his name, in technical journals.

Ralph Martin Hardgrove

RALPH M. HARDGROVE, research consultant, The Babcock & Wilcox Company, Alliance, Ohio, is internationally known for his work in the field of pulverized-coal firing and steam generation. The "Hardgrove method" for determining the grindability of coal, which has been adopted as a standard by ASTM and by the ASME Power Test Code, is widely used in the power-generating and coal-producing industries here and abroad. Mr. Hardgrove joined The Bailey Meter Company, Boston, Mass., in 1915, as sales and service engineer; later, in 1919, he became chief of engineering and research at Cleveland, Ohio. During this period he made important contributions to the early development of water-cooled furnace walls and combustion-control equipment, both of which in later years have revolutionized steam-generating practice. In 1927 he transferred to the Fuller Lehigh Company, following acquisition by B&W, as head of its research department. Here he was instrumental in the continuing advancement of water-cooled furnaces, the direct firing of pulverized coal, and successful introduction of slag-tap units for removal of ash in molten form. His efforts were also significant in the design and development of improved types of pulverizers and burners, requisite to the spec-



Medals to honor engineering achievement now permanently displayed in the Board Room at ASME Headquarters. Mounted on a three-panel fine-grained walnut screen, in bronze, are the Commemorative Medals, the ASME Medals, and the Joint Awards. The Commemorative Medals mark the twenty-fifth and fiftieth anniversaries of the Society. The ASME Medals include the ASME, Holley, George Westinghouse, Worcester Reed Warner, Spirit of St. Louis, Melville, and Pi Tau Sigma Medals. On the Joint Awards panel are exhibited the John Fritz and Hoover Medals of the Founder Societies, the ASME-AMA Gantt Medal, the ASME-SAE-IAS Guggenheim Medal, and the ASME-AMA-SAM-ACME Wallace Clark Medal. The ASME Medals are mounted above plaque listing past recipients.

tacular growth in capacity and performance of steam-generating equipment. When the Fuller Lehigh Company was absorbed by the parent company in 1931, he transferred to B&W in New York, N. Y., serving as head of the engineering-design division and of the research laboratory in Bayonne, N. J. Here his work included the original design and close association with later development of the B&W Cyclone Furnace, which has come into prominence as a new method of burning coal, now used in many of the nation's largest central stations. He contributed important elements to the design of mobile generating units, used under wartime conditions for strategic applications of power, and aided in the conversion of existing plants to coal firing to conserve vital fuel-oil supplies. He is credited with 46 U. S. Patents and an additional 35 patents as coinventor. He has had many papers published. Mr. Hardgrove, who joined the Society in 1919, is a membe of the ASME Power Test Code Committee No. 4, Stationary Steam Generating Units

Emory Neudeck Kemler

Emory N. Kemler, professor of mechanical engineering, and head of machine-design and instrumentation division, Institute of Technology, University of Minnesota, Minneapolis, Minn., is a widely known research and production engineer in the petroleum and other fields. Professor Kemler has supervised experimental and production-engineering work in the petroleum field, having been research engineer with Gulf Research and Development Corporation and chief production engineer with the Gypsy Division of Gulf Oil Corporation. He has been granted patents on well-weighing devices and developed the Kemler well weigher used in petroleum-production work. He has been associated with the University of Pittsburgh, Purdue University, New York University, and the University of Minnesota in teaching and research activities. He was also with Southern Research Institute as head of their Engineering Research Division and in 1949 became associate director of research at the Southwest Research Institute where he performed development work in connection with their divisions of Mechanical Engineering, Oceanography, and Petroleum Technology. Professor Kemler has written over 160 papers and articles for the technical press, many of which were in the machine-design, petroleum-production, and fluid-flow fields. His early ASME paper on "Flow of Fluids in Pipes" (1932) has been the basis for the development of currently used friction-factor curves by Pigott and others. He has been active in the development of the heat pump and is coauthor of a book on heat pumps published by McGraw-Hill Book Company in 1950. He is the holder of a considerable number of patents on the heat pump. Professor Kemler is the coauthor of books on "Elements of Mechanical Vibrations" (1943 and 1949) and "Aircraft Vibration and Flutter," 1944, published by John Wiley and Sons. He has been active in Society affairs. He is a past-chairman of the Midcontinent Section and is currently chairman of both the Minnesota Section and the Petroleum Division. He is a graduate of the University of Kansas, BS(ME), 1927, and ME, 1932, and the University of Pittsburgh MS, 1931, and PhD, 1934.

Peter Paul Kriek

Peter P. Kriek, director of engineering, American Enka Corporation, Enka, N. C., has made important contributions to engineering in the synthetic-textile field. He has many inventions to his credit. Before joining the Enka organization, he was in charge of technical operations for a shipping and stevedoring firm. Subsequently he was assistant chief of the department in the city engineering office in Rotterdam, Holland, which was in charge of installation and upkeep of all mechanical installations belonging to the city. He joined A.K.U., parent company of the American Enka Corporation, at Arnhem, Holland, in 1926. While with A.K.U., he worked in different capacities in the central engineering office and served as an engineer in their two plants in Italy. In 1929 he was sent to America to become chief engineer of the American Enka Corporation. He served continuously in this position until recently, when, with the advent of new plants, he was made director of engineering of the entire American Enka system. Mr. Kriek directed the design and installation of the Lowland, Tenn., plant. He has done a considerable amount of work in experimentation and expansion of methods in the manufacturing processes of synthetic fibers. Some important improvements and inventions for which he is responsible are a speed-checking device for accurately checking predetermined speeds of rotating shafts, a transmission mechanism which is used in rayon-spinning apparatus, and a mechanical expander for interiorly unsupported packages of rayon for maintaining the same proper condition for unwinding. He holds several patents.

Raymond Pierson Moore

Raymond P. Moore, Niagara Mohawk Power Corporation, Buffalo, N. Y., is an engineer of mechanical design who has made important contributions to the steam-power-plant field. One of his most important contributions was the work which led to the general reconsideration of the advantages of reheat initiated by the installation of the first reverse-flow reheat turbine in his company's Dunkirk Steam Station. This was made possible by the unit system which, with centralized controls, was practically unknown when first used in the Oswego Steam Station about 1940. These arrangements have now been generally adopted by the industry. The wet-bottom furnace as well as the water-sluicing system of removing molten ash were developed in a 1926 extension to the Huntley Station. This extension was also one of the first using unit-mill type of firing pulverized coal and required extensive development work. In 1922 he was assigned the job of making economic studies, mechanical and heat-balance calculations, writing specifications, and recommending equipment to be purchased for additions to the 95,000-kw Huntley Station. Since 1926 he has continued to supervise the mechanical design with gradually increasing responsibility to the present. During this time nine turbine-generator units have been or are being added to the Huntley Station, totaling 770,000-kw capability; the Oswego Steam Station has been built to a capability of 400,000 kw in four units, and the Dunkirk Steam Station with two 100,000-kw units put into service. Mr. Moore is the author of several papers and holds two patents.

Walter Siegerist

Walter Siegerist, president and chief engineer, The Medart Company, St. Louis, Mo., is internationally known for his work on mechanical methods of straightening all types and shapes of metals, and the centerless turning of bars, billets, and tubes. He has many inventions to his credit. One of his most useful inventions is the automatic roll-fed concentric centering centerless bar-turning machine now used in all cold-finishing steel plants. He invented an automatic "push-draw" (PD) centerless bar turner for turning small-diameter metal bars by means of sintered-carbide tools which was acclaimed by the German "Verein Deutsche Eisenhuttenleute" as the only successful method today. The U. S. Atomic Energy Commission developed the finishing procedure on uranium bars based entirely on the use of this Siegerist patented process. Mr. Siegerist developed an entirely new rotary two-roll straightening machine for high-speed polishing and restraightening operations. The new invention in this line consists of a six-roll multicycle pipe-and-tube straightening machine also designed for high-speed operation to keep up with modern high-speed tube mills. Another Siegerist development is a sizing-roll curvature that is today the standard curvature used in all ferrous and nonferrous mills where solid ground bars are produced. His accomplishments include redesigning the entire group of mechanical-power-transmissions items at the Medart Company and the development of such new products as sleeve Timken bearing unit mounts, bearing seals, and perfectly concentric compression shaft couplings. Mr. Siegerist is the author of a book "Boiler Data" and holds 19 patents.

Herman Weisberg

Herman Weisberg, mechanical engineer, electric engineering department, Public Service Electric and Gas Company, Newark, N. J., has made outstanding contributions to the power-generating field. He took a leading part in the development and use of alloy steels, and welding processes used therewith. He was one of the first engineers to advocate and use welded piping and valves in power-plant service. He has also pioneered in the use of higher steam pressures and temperatures in steam-power-plant design, including the highest operating combination of steam pressure and temperature in this country. The electrification of auxiliary drives, centralization of control, simplification of piping systems, and reduction of boiler-plant building volume embodied in plants of his design have contributed materially to reduction in operating and maintenance-labor costs. He joined the

Public Service Electric and Gas Company in 1935. Currently he has responsible charge of the over-all mechanical-engineering features involved in the engineering, design, and construction of some of the largest and most efficient thermal electric power-plant installations in the country. The most recent of these installations are the 455,000-kw Sewaren Generating Station, the new 290,000-kw Kearny Generating Station, and the 185,000-kw turbine-generator unit for the Burlington Generating Station. Mr. Weisberg has been active on many engineering society committees, and has contributed in a marked degree to advanced principles which have been incorporated in various standard codes. He has served the ASME on the Boiler Code Subcommittee on Stress Allowances for Ferrous Materials since 1949, the Special Research Committee on Furnace Performance Factors since 1941, and is past-chairman of the Research Committee, 1944–1947. From 1944 to 1947 he was a member of the Metropolian Section Executive Committee. At present his committee work includes: ASTM-ASME Joint Committee on Effect of Temperature on the Properties of Metals, Steam Power Panel, and Low-Temperature Flue-Gas Corrosion and Deposits. He is the author of several papers which were published in leading scientific and technical journals.

Arnold Weisselberg

Arnold Weisselberg, president, treasurer, and consulting engineer, Wyssmont Company, Inc., Long Island City, N. Y., has contributed many new developments in heat engineering, product engineering, tool engineering, and materials testing. Some of the projects executed by Mr. Weisselberg from 1930 to 1948 as consulting engineer are: A machine for simultaneous winding and universal packaging of rope yarn; automatic combustion control; various power-plant projects involving installation of oil burners, stokers, and pulverized-fuel-burning equipment; automatic hydraulic testing machines; automatic plating equipment; tooling up for quantity production of essential war products involving nearly every type of manufacturing method; vibration insulation through proper design of foundations or elimination of vibration sources; complete drying plants, employing driers of special design for the chemical and food industries; automatic spray-painting machines; and automatic washing machines. Mr. Weisselberg's laboratories were responsible for experimental research and tests in connection with the design and development of an electric bore gage which increased both the speed and accuracy of gaging the bore of hard chromium-plated caliber 0.50 machine-gun barrels. A pilot-plant project was also set up for hard chromium-plating caliber 0.50 machine-gun barrels. For these two accomplishments he was awarded the badge of merit by the Bureau of Ordnance, U. S. Navy. His laboratories also developed an electric bore profilograph for a 90-mm cannon for the Laboratory Service Division of Aberdeen Proving Ground. During World War II his company designed and developed equipment and plant and supervised production of sectional pipes for portable pipe lines. He has been active in the ASME Process Industries Division; chairman, Executive Committee, 1948. He is the author of several papers and holds five patents.

Congressional Hearings Report Issued by Atomic Industrial Forum

In a report entitled "The Meaning of the Congressional Hearings on Atomic Energy," issued by the Atomic Industrial Forum, a group of seven leading specialists from industry, labor, science, and the legal profession, established in April, 1953, called for early relaxation of the government monopoly in atomic energy to stimulate competition and speed technological development for peaceful purposes.

Members of the group were: Lloyd V. Berkner, president of Associated Universities, Inc., which operates the Brookhaven National Laboratory for the Atomic Energy Commission; James A. Brownlow, president of the American Federation of Labor's Metal Trades Department; Leonard W. Cronkhite, president of the Atomic Instrument Co. of Cambridge, Mass.; Gordon Dean, former AEC chairman, now with Lehman Brothers in New York, N. Y.; Walter E. Kingston, general manager of the atomic-energy division of Sylvania Electric Products, Inc., Bayside, L. I.; Casper W. Ooms, Chicago, Ill., attorney, who is chairman of the AEC's Patent Compensation Board and a former U. S. Patent Commissioner; and Albert F. Tegen, president of General Public Utilities Corp. of New York.

The group concluded that the government's atomic monopoly should be relaxed through early revision of the Atomic Energy Act of 1946, to permit private ownership of atomic-energy fuels and facilities paid for with private capital, more liberal patent rights than are presently available to industry, and a more effective sharing with industry of government-developed information useful in the peaceful development of atomic energy.

The group reached its conclusions during a conference sponsored by the Atomic Industrial Forum, November 19. The report is the first public release of the results of the conference, which was conducted by Dean E. Blythe Stason, chairman of the American Bar Association's special committee on atomic energy and dean of the law school of the University of Michigan.

In summing up the results of the conference, Dean Stason reported the following points had been made:

1 There is a clear need for economically competitive atomic power.

2 It is virtually certain that nuclear-reactor technology can be advanced to the point where atomic energy will be competitive generally with other sources of power.

3 The years immediately ahead should be devoted to intensive developmental activity.

4 In addition to government research and development, which should be continued within limits, free enterprise should be permitted—and encouraged—to participate as widely as possible to introduce the advantages of American competitive system into atomic-energy field.

5 To permit private participation, the present government monopoly in atomic energy should be relaxed as soon as possible, with government control through regulation substituted for the present method of government control through direct ownership and management of all fuels and basic facilities.

In a conclusion written shortly before publication of this report, Dean Stason referred to President Eisenhower's proposal for an international stockpile of fissionable material as follows: "There are parallels between what is envisioned here on a world-wide scale and what is envisioned within the United States by the proposed changes to the Atomic Energy Act. Both cases involve the allocation or sale

AIF Panel discusses the hearings before the Joint Congressional Committee on Atomic Energy. (*Left to right*) Casper Ooms, James A. Brownlow, Walter E. Kingston, Albert F. Tegen, Everett Hollis, E. Blythe Stason, Walker L. Cisler, Charles Robbins, Oliver Townsend, Oscar M. Ruebhausen, Leonard W. Cronkhite, Lloyd V. Berkner, and Gordon Dean.

of uranium and fissionable materials, accumulated largely for military purposes, to those who are interested in and engaged in atomic development for peaceful purposes.

"The United States has until now led the world, not only in the technological development of atomic energy, but also in the formulation of policies under which this development has progressed. If the United States could, by revising its domestic policies, provide a national example of what it envisions and hopes for on the international scene, it would do much in a concrete way to maintain its leadership and help steer the further development of atomic energy in the direction of the public good and of peace."

Walker L. Cisler, Hon. Mem. ASME, president of the Detroit Edison Company, is president of the Forum. Charles E. Robbins is executive manager of AIF.

Junior Forum . . .

Conducted by Joseph Schmerler, Assoc. Mem. ASME

The Heritage of Engineering

By Anthony F. Cuoco[1]

A YOUNG engineering graduate's entrance into the vastness of modern industry is a marvelous experience. What, just a short time previously, had been merely paragraphs in a textbook, or thoughts proposed by an instructor, suddenly turn into living reality. The graduate sees scientific principles transformed into the almost fantastic machines and devices of our modern civilization. To supplement his academic training, he has available the resources of the richest country in the world, whose industrial society has engineering thinking and analysis as its foundation. The young engineer is in an enviable position. He has the training and ability to design and construct, to formulate new ideas, and to transform old ones into useful devices which will benefit generations to come.

A romantic picture, true, but the young engineer should be jealous of the position that his chosen profession has helped him attain. He should direct his untiring efforts toward developing himself in his profession so as to be worthy of the high degree of responsibility and respect that he has inherited. Upon graduation, an obligation is accepted. This obligation can best be met by following the guideposts so carefully laid out by the engineering societies.

Technical Advancement Essential

Commencement, the name given to graduation ceremonies, is truly descriptive, for then education really begins. Thermodynamics and strength of materials are no longer only courses in a college schedule, but now represent the tools with which the young graduate earns his livlihood. The proficiency which he develops in applying his knowledge will be the greatest factor in deciding whether or not he receives satisfaction and gratification from an engineering career.

We are living in a constantly changing world. Technical and scientific advances occur almost daily. The practicing engineer must keep up with the progress that is being made in his field if he expects to gain any degree of success. This is particularly true of young engineers because they must create favorable impressions on their supervisors. They must show, without the benefit of maturity, capability of accepting responsibility. And accept responsibility they must, for in these times, when technically trained people are at a premium, industry simply cannot wait until its engineers "come of age."

Frequently, one must specialize or concentrate in a particular field. Although necessary, this can be a dangerous condition because it tends to narrow one's interests and scope of professional activity. However, through the technical societies, a young engineer can keep abreast of advancements made in all branches of his profession. Meetings and conferences sponsored by local sections provide an opportunity for exchange of information and ideas. Publications furnish further information. When these activities supplement his daily work, the engineer achieves an integrated, well-balanced appreciation of his vocation. For example, the design specialist can become more familiar with production practices in order better to adapt his creations to modern manufacturing processes. The engineering society in this way serves as a valuable agency for helping the young graduate achieve technical development that is so vital to his career.

Personal Development

A profession is characterized by the rules and regulations of practice that its adherents establish and impose upon themselves. In the engineering profession these restrictions are manifested by a sense of responsibility toward the public, clients, and employers.[2] This attitude is not automatically attained upon completion of formal college training. The significance of this standard of conduct must be fully realized before one can faithfully adhere to it.

Through membership in an engineering society, the young engineer has an opportunity to associate with older members of the profession. He can guide his conduct by their experience and maturity, and such guidance is a great asset to a successful career.

Perhaps professional poise is one of the most important traits that the young engineer can acquire. He should learn how to meet and talk with fellow engineers as well as members of other professions. He should become fully cognizant of his civic responsibility as a professional man and be prepared to use his knowledge for the good of the community.

The engineering society is an excellent ground for attaining these goals. There the young graduate achieves the necessary recognition and becomes unmistakingly identified with his profession. He is the recipient of integrity and respect that one engineer accords his coworker.

Of course the engineering society also provides the fellowship that is prevalent among people with common interests. Lasting friendships and fraternal spirit are important parts of success, and the young engineer must constantly strive for the respect and esteem of his colleagues.

Active Participation Is Necessary

The full benefits that can be derived from membership in an engineering society cannot be obtained if the young engineer has only a passive interest in society activities. Active participation is necessary.

Activities in any society require a good deal of planning and preparation. Meetings must be arranged, new members secured, and interests stimulated. Also, a society will frequently embark upon projects of civic or educational interest which are beneficial to the entire community.

If the young engineer takes an active interest in these functions, his development in the profession will be greatly enhanced. Participation on committees responsible for arranging meetings and conferences will bring him in contact with men in all branches of engineering who are experts in their fields. If he becomes engaged in the administrative duties of his society, he will see how co-operation between officers and members provides a smooth-running, well-functioning organization. After all, a technical society is administered with the same principles that are used in managing industrial enterprises. Knowledge of management techniques should be a welcome addition to the education of an engineer aspiring to a satisfying career.

A young engineer is in an excellent position to take advantage of these opportunities. Usually his duties on the job are not yet of too restricting a nature, so that he has time available to spend on society activities. He will find that his exuberance and outlook are accepted warmly by his older colleagues.

Success, or achievement, may mean something different to each of us. No matter what our conception, agreement can probably be reached on the fact that any attainment sought by the young engineer depends, almost entirely, on technical advancement and personal development. The engineering society provides an excellent vehicle for obtaining the true engineering perspective, and hence real professional development.

[1] Time-Study Engineer, Eclipse-Pioneer Division, Bendix Aviation Corporation, Teterboro, N. J. Assoc. Mem. ASME.

[2] *Canons of Ethics for Engineers:* Prepared by the Engineers' Council for Professional Development.

Actions of the ASME Executive Committee

A MEETING of the Executive Committee of the Council was held in the rooms of the Society on Feb. 19, 1954. L. K. Sillcox, chairman, presided. In addition to Mr. Sillcox, there were present: Thompson Chandler, H. E. Martin, A. C. Pasini, W. F. Thompson of the Committee; J. L. Kopf, treasurer; E. J. Kates, assistant treasurer; Joseph Pope, chairman, Finance Committee; V. Weaver Smith, chairman, Organization Committee; H. R. Kessler, vice-president; F. L. Bradley and R. B. Lea, directors at large; C. E. Davies, secretary, O. B. Schier, 2nd, assistant secretary, and Ernest Hartford, deputy secretary.

Dinner Meeting

A dinner meeting was held at The Engineers' Club, New York, N. Y., Feb. 18, 1954, at which members of the Executive Committee met with the ASME representatives on United Engneering Trustees, Inc., The Engineering Foundation, and the Engineering Societies Library Board. The following were present: L. K. Sillcox, Thompson Chandler, H. E. Martin, and W. F. Thompson of the Executive Committee; H. R. Kessler, vice-president; R. B. Lea, director at large; E. J. Kates, assistant treasurer; V. Weaver Smith, chairman, Organization Committee; J. L. Kopf and R. F. Gagg, representatives on UET (W. F. Thompson is also a representative); E. L. Robinson, representative on The Engineering Foundation; F. M. Gilbreth, representative on the Library Board; J. H. R. Arms, secretary, UET; Frank Sisco, director, The Engineering Foundation; R. H. Phelps, director, Library; C. E. Davies, secretary, and Ernest Hartford, deputy secretary.

The operating problems of The Engineering Foundation and the Library were discussed and the proposed plans for the location of a new Engineering Societies Building were reviewed and discussed at length.

Dues-Exempt Members

On recommendation of the vice-presidents, The Committee voted to send each member who became dues-exempt his life-membership card and a letter signed by the president, copy of the letter to be sent to the Section so the Section may, if it wishes, arrange for public recognition.

Consulting-Engineering Practice

H. R. Westcott was appointed by the Board on Education and Professional Status to take the lead in reorganizing the work of the Society in connection with consulting-engineering practice. At a meeting of interested members, held Dec. 3, 1953, the following statement of purpose of the Committee was agreed on: "To promote the standards, development and utility of, and interest in, the professional practice of consulting engineering to the end that it may serve commercial and industrial enterprises and public needs more effectively and efficiently." Mr. Westcott was made committee chairman and was authorized to appoint a small working executive committee.

Certificates of Award

A certificate of award was granted to Crosby Field, retiring chairman of the Board on Technology.

The following retiring chairmen of Sections also received certificates of award: Cecil F. Warner, Central Indiana Section; and Robert C. Patterson, Chattanooga Section.

David S. Jacobus

At its meeting on Dec. 28, 1953, the Committee authorized a special certificate for David S. Jacobus, past-president and Hon. Mem. ASME, to commemorate his 65 years of ASME membership. Mr. Jacobus acknowledged the certificate and expressed his thanks and appreciation. The certificate was given to him on his 92nd birthday at his home in Montclair, N. J., by the following group: Past-presidents E. G. Bailey and H. V. Coes; Vice-President H. R. Kessler; Director at Large F. L. Bradley; and W. A. Shoudy, a member of the Old Guard Committee.

New Engineering Societies Building

The Council, at its meeting Nov. 29–30, 1953, authorized a letter ballot to the membership regarding a new Engineering Societies Building. The Executive Committee approved the communication and ballot to be sent to the membership regarding decision as to a new building.

EUSEC Conference

At the EUSEC Conference on Engineering Education and Training (Conference of Representatives of Engineering Societies of Western Europe and U.S.A.), in Paris, France, September, 1953, a recommendation was adopted that a Second Conference be held in Zurich, Switzerland, beginning Sept. 27, 1954. The Committee voted to request the Engineers' Council for Professional Development to provide ASME representation at the forthcoming conference and at subsequent conferences, reports being made periodically to the ASME Council and its Board on Education and Professional Status and Education Committee.

Third UPADI Convention

The Engineers Joint Council, at its meeting on Jan. 15, 1954, voted in connection with the Third UPADI Convention in São Paulo, Brazil, Aug. 2–12, 1954, that James M. Todd, president, UPADI Fund, Inc., and Joseph Pope, chairman, Committee on International Relations, be named as chairman and vice-chairman, respectively, of the EJC delegation. EJC voted that each of the constituent societies nominate one delegate and two alternates for approval by EJC at its May, 1954, meeting. The Executive Committee nominated the following delegate and alternates to represent ASME at the convention: George Browne, delegate, New York, N. Y.; James W. Cox, alternate, New York, N. Y.; and S. E. Reimel, alternate, Washington, D. C.

Presidential Appointments

The following presidential appointments were confirmed: S. E. Reimel, to Chamber of Commerce of the United States, luncheon meeting of Construction Industry Advisory Council, Feb. 16, 1954; E. R. Granniss to White House Conference on Highway Safety, Washington, D. C., Feb. 17–19, 1954.

Carl F. Braun

The death of Carl F. Braun, Hon. Mem. ASME, on Feb. 4, was noted with regret.

Engineering Societies Personnel Service, Inc.

THESE items are from information furnished by the Engineering Societies Personnel Service, Inc., in co-operation with the national societies of Civil, Electrical, Mechanical, and Mining and Metallurgical Engineers. This Service is available to all engineers, members, or nonmembers and is operated on a nonprofit basis.

In applying for positions advertised by the Service, the applicant agrees, if actually placed in a position through the Service as a result of an advertisement, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient nonprofit personnel service and are available upon request. This also applies to registrant members whose availability notices appear in these columns. Apply by letter, addressed to the key number indicated, and mail to the New York office.

When making application for a position include six cents in stamps for forwarding application to the employer and for returning when necessary. A weekly bulletin of engineering positions open is available at a subscription of $3.50 per quarter or $12 per annum for members, $4.50 per quarter for nonmembers, payable in advance.

New York	Chicago	Detroit	San Francisco
8 West 40th St.	84 East Randolph St.	100 Farnsworth Ave.	57 Post St.

Men Available[1]

Mechanical Engineer, BSME, 39, executive background; 18 years' wide experience design of special machinery, automotive, tractor, hydraulics, rubber, production equipment, as design engineer and consultant. Responsible administrator. Registered, Ill., Colo., Texas, Ga., Okla. "Who's Who Commerce and Industry." Me-66.

Refrigeration Engineer, 29, over eight years' practical, technical, and sales experience in refrigeration, chemical, and marine engineering. Desires progressive position. Citizen of India. Presently employed in the Far East. Will relocate anywhere. Me-67.

[1] All men listed hold some form of ASME membership.

Mechanical Engineer, Lowell Institute, M.I.T graduate; 13 years' research and development experience in aircraft, turbines, and missiles; nine years' experience in design of mechanisms, servomechanisms, gear trains, and electromechanical devices and instruments. Me-68.

Construction Engineer, BS (ME and EE), 29, married, two foreign contracts completed; ten years' varied experience in design, field inspection, and supervision; some maintenance—power plants, power distribution, industrial circuits, circuit analysis and motor control, system planning, machinery installation, experience in handling personnel. Knowledge of Spanish, Italian, and Portuguese. Consider position anywhere in the world. Me-69.

Mechanical Engineer, BME from NYU, 1951, 34, single. Desires position as trainee for fire-prevention, fire-underwriting, or safety engineer. Free to travel and have late model car. Me-70.

Manager, precision manufacturing, 48, BS, MS, broad experience in engineering, tooling, methods, cost reduction, management controls, labor, etc. Can develop a strong profitable organization. Prefers New York metropolitan area. Me-71.

Manufacturing Executive, 39, ME, desires position as works manager or plant manager. Experience as works manager and general superintendent includes quality control, cost reduction, time study, production planning, process, and plant engineering in foundry machining and assembling operations. Me-72.

Mechanical Engineer, 32, ScD, married, experienced in teaching, research, and as consultant to industry in thermodynamics, heat transfer, and fluid mechanics. Desires position as assistant or associate professor. Me-73.

Positions Available

Instructor or Assistant Professor in the field of manufacturing processes and/or production engineering, to act as field representative of engineering-research department to small industries, and also to teach in department of industrial engineering. Must be graduate in mechanical or industrial engineering, considerable industrial experience in the basic manufacturing process of machine work, forging, welding, and foundry. $5400–$6000. Ten or 12-month contract. East. Position starts July 1, 1954. Y-9711.

Mechanical Engineer to work on the design and application of carbon for pump seals, bearings, compressor rings, impeller blades, and other specialized equipment. Must be graduate mechanical engineer. American citizen. Previous experience in design and service of equipment using seals, bearings, etc., desirable. Some travel anywhere in the U. S. $4500–$6500, plus travel and living expenses. Headquarters, New York metropolitan area. Y-9726.

Industrial Engineer, under 55, to analyze operations, make cost studies, plan improvements and wage incentives, for needle-trades manufacturer. $7000–$9000, plus bonus. Puerto Rico. Y-9727.

Designer, mechanical-engineering training and experience on stainless-steel food equipment, to redesign doughnut, ice cream, and other machinery to meet sanitary regulations. $6500–$7500. New York, N. Y. Y-9728.

Department Head, minimum of ten years' experience in the design of packaging machinery and other equipment items from initial design to field installation and maintenance. Considerable traveling. $12,000–$15,000. Headquarters, Pa. Y-9734.

Sales Engineer, 35–45, mechanical-engineering background preferred, some knowledge of automotive-body design, and some familiarity with heavy stampings. Will work closely with customers' engineering organization in developing final product design. Much of the work will be of a "service" nature. $10,000–$12,000. Midwest. Y-9737.

Engineers. (*a*) Chief engineer, 40–50, mechanical graduate, at least ten years' experience in responsible charge of design, development and application of compressors, air-conditioning, and refrigeration equipment. $12,000–$15,000. New York State. (*b*) Plant manager, 40–50, mechanical graduate, at least ten years' supervisory sheet-metal products-manufacturing experience, to take full charge of operations. $15,000–$20,000. N. J. (*c*) Design engineer, 30–40, experience in refrigeration and air-conditioning compressor design, and experience in open-type compressors. Should be willing to work with other design engineers, with lab technicians, and be able to consult with the chief engineer. Some knowledge of production facilities and procedure. $10,000–$11,000. New York State. Y-9742.

Plant Engineer, 30–40, mechanical graduate, at least five years' experience in textile industry, to design special machinery, plan installation, and supervise equipment maintenance for fabricator of narrow fabrics. $6000–$8000. Mass. Y-9744.

Chief Mechanical Engineer to administer engineering department. Must have minimum of five years' experience in the plastics industry, primarily in injection molding. $8000–$10,000. N. J. Y-9749.

Instructor or Assistant Professor in mechanical engineering. Should be a mechanical or industrial-engineering graduate, preferably with MS degree and practical and/or teaching experience, to teach industrial-engineering subjects, such as: production laboratory, production planning and control, time-and-motion study, or materials handling. Start Sept. 1, 1954. Salary open. Ohio. Y-9756.

Chief Process Engineer, mechanical, heavy experience in the processing and tooling of progressive and compound dies necessary for blanking, forming, cupping, and piercing of brass, aluminum, and stainless-steel parts required for electromechanical devices. Will consider only applicants with several years' responsible experience with a single firm. $10,000, and up. East. Y-9763-D-9172.

Production-Planning Engineer, under 40, mechanical or industrial degree desirable. Must have about five years' production experience in the metal-fastener industry. Will organize and direct a production-planning department for a manufacturer of metal-fastening items. $8000–$10,000. East. Y-9764-D-9185.

Mechanical Engineer, young, with design, promotion, and product-application experience covering high-pressure laminated plastics and fibre-glass reinforcements. $5200–$6500. Detroit, Mich. Y-9768.

Field Engineer, mechanical graduate, at least five years' air-conditioning, heating, and ventilating installation experience for contractor. $6000. New York, N. Y. Y-9770.

Sales Engineer, 26–32, mechanical graduate, air-conditioning and refrigeration experience for sales and correspondence covering coils, compressors, blowers, and other accessories. $5200. New York, N. Y., later assignment in East or Midwest. Y-9776.

Department Head, industrial - engineering graduate, master's degree, to head industrial-engineering department for 1954–1955 school year. $5000 for 8½ months. Pa. Y-9778.

Teaching Personnel. (*a*) Assistant professor or associate professor to take responsible charge of engineering drawing, descriptive geometry, and kinematics. MS(Me) degree required. $5600 for nine months. (*b*) Instructor to teach engineering drawing, descriptive geometry, and kinematics. MS(ME) desirable; BS(ME) required. $4100 for nine months. South. Y-9779.

Development Engineer, up to 50, three years' experience developing home-laundry equipment, for work in this field for a manufacturer of major appliances. $7000–$10,000. Ill. C-1663.

Engineers. (*b*) Section head, mechanical graduate, ten years' experience in electromechanical design; some in supervisory category. Extensive mechanical-design experience, preferably in military electronic equipment. Experience in electromechanical design of airborne equipment desirable. Capable of organizing and directing activities of large group of top-level engineers $10,000. (*d*) Engineering specialist at least BS in mechanical or aeronautical engineering, about five years' experience. Background in aircraft industry with particular emphasis on knowledge of weight control and ability to achieve high strength-to-weight ratio structures. Experience in mechanical design of airborne electronic equipment desirable. $8400–$10,000. Mass. C-1667.

Mechanical Engineer, graduate, to supervise design and preparation of drawings for heating, ventilating, and air-conditioning work, and air, water, and oil-piping systems specializing in hydro plants. Must have good appearance, capable of presenting and discussing work, and to supervise work of others, for consulting firm in hydro plant work. $7200–$10,800. Ill. C-1688-(*b*).

Safety Engineer, over 28, BS or MS in chemistry or chemical engineering, five years' experience in industrial safety in chemical-manufacturing plant. Knowledge of chemical-engineering procedures and safety methods. Will formulate "selling" and carrying out comprehensive safety program. Will be given responsibility for safety program of large division of company, expected to direct work of others in division. $6000–$8000. Mo. C-1669.

Project Engineer, about 40, mechanical or metallurgical graduate, at least ten years' experience in automotive industry. Knowledge of fabrication of light metals. Experience in nonferrous fabricating field, preferably aluminum. Will take charge of automotive section of large company on design and development. $10,000, and up. Ill. C-1698.

Project Engineer, 30–35, at least two years' experience in office equipment, cameras, or small appliance design. Knowledge of film-strip projectors. Will do project work developing new visual-education equipment such as film-strip projectors, cameras, etc., for a manufacturer of cameras. $6500–$7000. Ill. C-1707.

Candidates for Membership and Transfer in the ASME

THE application of each of the candidates listed below is to be voted on after April 23, 1954, provided no objection thereto is made before that date and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the Secretary of The American Society of Mechanical Engineers immediately.

Key to Abbreviation

R = Re-election; Rt = Reinstatement; Rt & T = Reinstatement and Transfer to Member

New Applications

For Member, Associate Member, or Affiliate

ALLENDORF, CARL H., Cincinnati, Ohio
ALTORFER, HENRY F., Canton, Ohio
BAILEY, BETTY LOU, Cincinnati, Ohio
BAKER, MONTELLE M., Pekin, Ill.
BARBS, FRANK, Litchfield, Conn.
BARISH, BENJAMIN, Painesville, Ohio
BARON, MELVIN L., New York, N. Y.
BARROS, ION D., Montevideo, Uruguay
BATESON, NORMAN E., Hammond, Ind.
BECHT, CHARLES, Newark, N. J.
BELL, CHARLES R., Chicago, Ill.
BENNETT, ROBERT B., Saginaw, Mich.
BERGER, JAMES E., Pennsauken, N. J.
BLATT, FRED M., Cambridge, Mass.
BLEIWEIS, ALFRED, Kenmore, N. Y.
BLOOD, LELAND C., Monroe, Mich.
BOGERT, RUSSELL S., Corning, N. Y.
BRINER, GEORGE F., Mohnton, Pa.
BROADHEAD, MORGAN A., Naugatuck, Conn.
BROWN, WILLIAM B., Baltimore, Md.
BRUNNER, MILTON F., Chicago, Ill.
BUCHMANN, OTTO J., Canton, Ohio
BURKS, GEORGE E., Peoria, Ill.
BYRD, PAUL R., Paducah, Ky.
CADDELL, ROBERT M., Ann Arbor, Mich.
CASHMAN, RICHARD J., Redwood City, Calif.
CHEN, LESLIE H., St. Louis, Mo.
CHILTON, HORACE T., JR., Tulsa, Okla.
CLARK, MILTON S., Wilmington, Del.
CLARK, SAMUEL K., Cleveland, Ohio
CLEMENT, JOSEPH A., Victoriaville, P. Q., Can.
DAVIS, JOHN E., Indianapolis, Ind.
DEKANSKI, LEON M., New York, N. Y.
DIAMOND, HENRY H., Forest Hills, L. I., N. Y.
DOERR, CHARLES S., Philadelphia, Pa.
DOLLIN, FRANK, Newcastle-on-Tyne, England
DREISS, WILLIAM F., San Antonio, Texas
FITZSIMMONS, DONALD L., Louisville, Ky.
FORBES, SHERMAN G., JR., Beaumont, Texas
FORREST, GEORGE M., New York, N. Y.
FRENCH, GEORGE R., Whiting, Ind.
GAMMETER, ELMER, Whitefish Bay, Wis.
GASKIN, WILLIAM R., Peterborough, Ont., Can.
GERLACH, CARL H., Solon, Ohio
GERMAN, ALFRED, Scarsdale, N. Y.
GHOSH, GANGA N., Calcutta, India
GOLDING, PETER C., Brighton, Trinidad, B. W. I.
GORTEN, GEORGE, Los Angeles, Calif.
GREGORIO, JOHN A., Staten Island, N. Y.
HAMILTON, RICHARD F., Castro Valley, Calif.
HANNA, ROGER S., Hollis, N. Y.
HARLESTON, HUGH, JR., Mexico, D.F., Mex.
HENSARLING, NOLAN B., Austin, Texas

(*ASME News continued on page 396*)

THIS MAN IS WRITING BOILER INSURANCE

● Figuratively, that is.

He is a Yarway craftsman, assembling Yarway Remote Liquid Level Indicators . . . and the care he is taking is one of the reasons why Yarway Remote Indicators are just about the safest boiler insurance you can buy.

Every part is precision-machined. Every assembled instrument is precision-tested. In the Yarway Research Laboratory a stock indicator passed the equivalent of 100 years normal use with no parts replacements, no serious wear. In thousands of power plants, ashore and afloat, Yarway Indicators are giving similar dependable service.

This is typical. All Yarway products contain the same good engineering and skilled workmanship, aimed at one objective—better service in your plant.

Make Yarway your way.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
Branch Offices in Principal Cities

YARWAY **steam plant equipment**

BLOW-OFF VALVES
WATER COLUMNS AND GAGES
REMOTE LIQUID LEVEL INDICATORS
EXPANSION JOINTS
DIGESTER VALVES
STEAM TRAPS
STRAINERS
SPRAY NOZZLES

HILL, JOHN A., Minneapolis, Minn.
HISGEN, JOHN C., Tulsa, Okla.
HOWARD, PHILIP J., Kansas City, Mo.
HUTH, JOHN H., Pacific Palisades, Calif.
JANZOW, LEWIS S., Dorchester, Mass.
JOHNSON, VICTOR J., Boulder, Colo.
JOHNSTON, EDWARD, JR., Roslyn, Pa.
JONES, JOSEPH F., Springfield, Vt.
KARDOS, GEZA, Lachine, P. Q., Can.
KEMP, GAIL W., San Antonio, Texas
KING, CECIL D. G., Monterey, Calif.
KIRSCHT, ARTHUR A., Schenectady, N. Y.
KLICH, EDWARD J., Chicago, Ill.
KONTROVITZ, HAROLD S., Toledo, Ohio
KORSGREN, WILLIAM W., Army Chemical Center, Md.
KUEBLER, CARL K., New Haven, Conn.
KULLMAN, ROGER G., Syracuse, N. Y.
LANDBACK, PEARL E., Detroit, Mich.
LEEDS, HAROLD J., San Francisco, Calif.
LEWIS, J. ALBERT, North Hills, Pa.
LIANG, STEPHEN T., Roxbury, Mass.
LIGHT, FREDERICK H., Philadelphia, Pa.
LINDEMANN, FRED W., Cincinnati, Ohio
LITZLER, CYRIL A., Cleveland, Ohio
LOPER, JACK L., Natchez, Miss.
LORMAN, WALTER J. S., London, England
LUNCHICK, MYRON E., Levittown, L. I., N. Y.
MACDONALD, PATRICK J., Levis, P. Q., Can.
MAGEE, JOHN J., JR., Ridley Park, Pa.
MARTIN, FRED R., St. Louis, Mo.
MATHENY, CARLTON M., Charleston, W. Va.
MATHISEN, TORMOD O., Brooklyn, N. Y.
MATTES, HOWARD L., Madison, N. J.
MAY, CLAUDE H., Columbus, Ohio
MCARTHUR, ROBERT D., Cleveland, Ohio
MCCANLESS, WALTER F., Chester, S. C.
MCCOLLUM, MARVIN P., Los Angeles, Calif.
MERCIER, JACQUES H., New York, N. Y.
MERRYMAN, JOHN W., Klamath Falls, Ore.
MILLER, JAMES R., Cincinnati, Ohio
MORGAN, JOHN G., Chicago, Ill.
MORRISON, NEIL A., Floral Park, N. Y.
MORSE, EDWIN R., New York, N. Y.
MOUSER, MERLE E., Chicago, Ill.
MURAIDA, DANIEL H., JR., San Antonio, Texas
NAGEL, ALFRED W., Anniston, Ala.
NEIDNER, ROBERT, Richland, Wash.
NEWMAN, ARTHUR G., Campbellford, Ont., Can.
OBARSKI, RICHARD W., Akron, Ohio
ORDECKI, ADAM S., Elizabeth, N. J.
OSOFSKY, IRVING B., Mentor, Ohio
PETERSON, OSCAR A., Westwood, N. J.
PHANKUF, WILROSE J., Hudson, Mass.
PIKUNAS, WALTER P., Crafton, Pa.
PISASALE, SALVATORE F., Philadelphia, Pa.
RANDOLPH, WILLIAM J., JR., Corning, N. Y.
RASSWEILER, CLIFFORD F., Short Hills, N. J.
REIN, SAMUEL W., Beacon, N. Y.
RICE, HAROLD D., New Canaan, Conn.
RIDGWAY, JAMES E., Philadelphia, Pa.
RIELLY, DONALD H., Pittsburgh, Pa.
ROGERS, JOSEPH V., Trail, B. C., Can.
ROSLUND, JOHN, Richland, Wash.
ROTHMAN, JULES A., Forest Hills, N. Y.
RUFFLES, RONALD P., Worcester, England
RUTLEDGE, JAMES E., Evansville, Ind.
SARKAR, SANTOSH K., Knebworth, Herts., England
SCHERER, GEORGE J., Kansas City, Mo.
SCHMIDT, STANLEY A., Lynn, Mass.
SCHNAIDER, JOSE L. R., Mexico, D. F., Mex.
SCHWENDNER, EDWARD A., Houston, Texas
SCRUGGS, SAMUEL Y., Kenova, W. Va.
SELLERS, H. NELSON, JR., Cumberland, Md.
SELOT, GYAN S., Jabalpur, India
SETTERBLADE, EARL O., Stratford, Conn.
SEWARD, JAMES E., JR., Toledo, Ohio
SHAFER, RUTH I., New York, N. Y.
SHAPIRO, LEONARD, Trenton, N. J.
SHARMA, BRIJ M., Delhi, India
SHAVER, WILLIAM R., Hammond, Ind.
SHERMAN, JACK J., Erdenheim, Pa.
SHERLOCK, ROBERT H., Ann Arbor, Mich.
SIRMAY, EMIL S., Trenton, N. J.
SMORTCHEVSKY, JOHN J., San Francisco, Calif.
SNYDER, ROBERT I., Glendale, Calif.
SOFT, ROLAND G., Genoa, Ohio
SOLNICK, ROBERT L., Whittier, Calif.
STANOJEV, ALEXANDER C., Philadelphia, Pa.
STIMMLER, JOSEPH A., JR., Penn Wynne, Pa.
STOCKS, E. GORDON, JR., Plainville, Conn.
STONER, RAYMOND R., Sartell, Minn.
SWINEHART, MARION L., Martinsville, Ind.
SZABO, KALMAN N., Aurora, Ill.
TAO, LIANG N., Newark, N. J.
THOMPSON, WILLIAM H., Downers Grove, Ill.
TOWNSEND, RAYMOND P., Hartsdale, N. Y.
TYLLICK, DENNIS C., Bellaire, Texas
VAN DER SLUYS, WILLIAM, Homewood, Ill.
WAGNER, ROY W., Toledo, Ohio
WALLACE, CHARLES J., Washington, D. C.
WALSH, RALPH E., Long Branch, N. J.
WASSYNGER, HENRY, Philadelphia, Pa.
WAUGHTAL, HARRY A., Tulsa, Okla.
WEEKS, GENE M., New York, N. Y.
WHITNAH, GORDON R., Minneapolis, Minn.
WILLIAMS, DONALD P., Norwood, Pa.
WISEGARVER, GERALD, Kansas City, Mo.
WOFFORD, ANDREW W., Hartford, Conn.
WOODBRIDGE, JAMES O., Tullahoma, Tenn.
WOODS, JOHN G., Philadelphia, Pa.
YOUNG, WALTER J., Prospect Park, Pa.
ZAINOON, NICHOLAS A., Moundsville, W. Va.
ZEIGLER, JACK M., Charlotte, N. C.

Change in Grading

Transfers to Member, Associate Member, or Affiliate

ARONOFSKY, JULIUS S., Dallas, Texas
BRITT, WILLIAM H., Minetto, N. Y.
CORNELL, WILLIAM G., Cincinnati, Ohio
MACKLIN, LEO, New York, N. Y.
MULLEE, WILLIAM R., Pawling, N. Y.
WUERTZ, EMIL S., Colonia, N. J.

Transfers from Student Member to Associate Member 50

Obituaries . . .

Matthias A. Beck (1859–1953), retired engineer, Milwaukee, Wis., died Nov. 3, 1953. Born, Cascade, Iowa, June 22, 1859. Parents, Frank and Loes Beck. Education, no formal education; apprenticeship, Illinois Central Railroad repair shops, Waterloo, Iowa. Married Martha Struppe, 1894 (died 1942). Mem. ASME, 1886. Received ASME Distinguished Service Certificate in 1951 for 65-year membership. In 1932 he became honorary member of the Engineers' Society of Milwaukee.

James Cary Bonniwell (1920–1954), development engineer, Luken Steel Co., Coatesville, Pa., died Jan. 2, 1954. Born, Rockville Centre, N. Y., Aug. 1, 1920. Parents, Charles and Marion (Cary) Bonniwell. Education, BS(ME and IE), University of Michigan, 1948; graduate work at Lehigh and Villanova Universities. Married Anna Louise Hunsicker, Jun. ASME, 1948. Survived by wife; a daughter, Karen Ann; his mother; and a brother, Robert, Northport, N. Y.

Edgar Montalbert Bouton (1888–1953), retired Sept. 1, 1953, as manager of engineering, Elevator Division, Westinghouse Electric Corp., Jersey City, N. J., died Dec. 4, 1953. Born Klamath Falls, Ore., Feb. 28, 1888. Education, BS(EE), Iowa State College, 1914. Married Anna Bell Ryle. Mem. ASME, 1943. He was responsible for the first successful application of variable voltage control to the operation of elevators. He also developed an automatic landing control which greatly simplified elevator operation. In recognition of these accomplishments, Westinghouse awarded him its Order of Merit for his significant contributions and leadership in the field of electric-elevator engineering. He was a member of the executive and sectional committees of the National Elevator Code and the National Bureau of Standards. He was author of several technical papers and held more than 40 patents on elevators. Survived by wife and three sons, William R., East Orange, N. J., John A., Prescott, Ariz., George H., Ridgewood, N. J.; a brother, Charles N., and a sister, Mrs. Harold Miller, both of Glyndon, Minn.; and six grandchildren.

Eugene Adolphus Brooks (1891–1953), retired since March, 1953, co-owner, Boiler Equipment Service Co., Atlanta, Ga., died Oct. 27, 1953. He was also former secretary-treasurer of the Atlanta Carrier Corp., which he founded with the late C. L. Templin in 1937. Born, Atlanta, Ga., June 8, 1891. Parents, John B. and Lillie D. (Burns) Brooks. Education, BS(ME), Georgia School of Technology, 1912. Married Zaretta Estes, 1912. Assoc-Mem. ASME, 1918; Mem. ASME, 1925. He served the Society as chairman, Atlanta Section, 1922. He contributed papers on power-plant equipment, combustion, and Boiler Code work to ASME journals; also held patents on refractory walls. Survived by wife; two daughters, Mrs. T. E. Garner, Mrs. Dona B. Burns; two sons, Eugene E., John L.; a brother, E. Burns Brooks; and five grandchildren.

Neil Hamilton Brown (1891–1953), of Brown & Morrison, manufacturers' representatives, Charlotte, N. C., died Nov. 21, 1953. Born, Erie, Pa., April 28, 1891. Parents, William and Sophie (Hamilton) Brown. Education, BS, The Pennsylvania State College, 1912. Mem. ASME, 1939. He served the Society as Piedmont Section chairman for one year and secretary, three years. He was Regional Delegate to the Atlanta Conference, 1945. Survived by wife, the former Connie Prince Flowe; a daughter, Mrs. Frederick Allin, Wadsworth, Ohio; and a stepdaughter, Mrs. Robert M. Stone, Derita, N. C.

Harry Ellis Bryne (1902–1953), plant engineer, Taylor Forge & Pipe Works, Cicero, Ill., was killed in an automobile accident on Sept. 4, 1953. Born, Harvard, Neb., July 3, 1902. Education, high-school graduate, 1921; extension courses, University of Minnesota. Mem. ASME, 1944.

Louis A. Cornelius (1870–1953?), whose death was recently reported to the Society, was president, Wolverine Brass Works, Grand Rapids, Mich. Born, Adrian, Mich., May 4, 1870. Education, graduate, Grand Haven High School. Mem. ASME, 1931. He was director of ASSE and his research papers were published in the ASSE Annual.

Daniel Edward Donovan (1891–1953), president, Steamship Service Corp., Sparrows Point, Md., died Dec. 1, 1953. Born, Cherryfield, Me., Dec. 1, 1891. Education, graduate Harrington High School; 1 year, Shaws Business College. Mem. ASME, 1944.

Stevenson H. Findlater (1899–1953), assistant to president, National Tube Co., Pittsburgh, Pa., died Nov. 20, 1953. Born, San Angelo, Texas, Aug. 29, 1899. Parents, John and Edith Findlater. Education, BS, Massachusetts Institute of Technology, 1923. Jun. ASME, 1927; Assoc-Mem. ASME, 1934; Mem. ASME, 1935. He held patents on a bar-compensation device and automatic guides for hot mills.

Wharton Kinsey Gray (1896–1953), chief engineer, Spreckels Sugar Co., San Francisco, Calif., died Nov. 20, 1953. Born, Denver, Colo., Oct. 18, 1896. Parents, Horace A. and Nellie (Kinsey) Gray. Education, BS(ME), University of Colorado, 1919. Married Harriet Taylor Brace, 1920; two sons, Robin W. and Wharton K., Jr. Jun. ASME, 1928; Assoc-Mem. ASME, 1931; Mem. ASME, 1935.

Warren Dunham Hardaway (1896–1952), superintendent, hydroelectric production and transmission, Public Service Co. of Colorado, Denver, Colo., died Oct. 27, 1952, according to a notice recently received by the Society. Born, Ord, Neb., Aug. 17, 1896. Parents, William E. and Jessie (Dunham) Hardaway. Education, BS(EE), Iowa State College, 1919. Married Almira Barrett, 1923; children, Mary, Harriet. Author of several papers published in professional and trade journals. Mem. ASME, 1929.

Charles D. Hawley (1901–1953), manager of administration, Ethyl Corp. Research Laboratories, Detroit, Mich., died Nov. 28, 1953. Born, East Tawas, Mich., Sept. 17, 1901. Parents, Thomas G. and Mary D. Hawley. Education, BS(ME), Oregon State College, 1924; graduate work in engineering, Harvard University, 1926–1927. Married Barbara Kirkland, 1933. Author of articles published in scientific and technical journals. Mem. ASME, 1945. Survived by wife and four children, Mary B., Thomas G., 3rd, John K., R. Andrew.

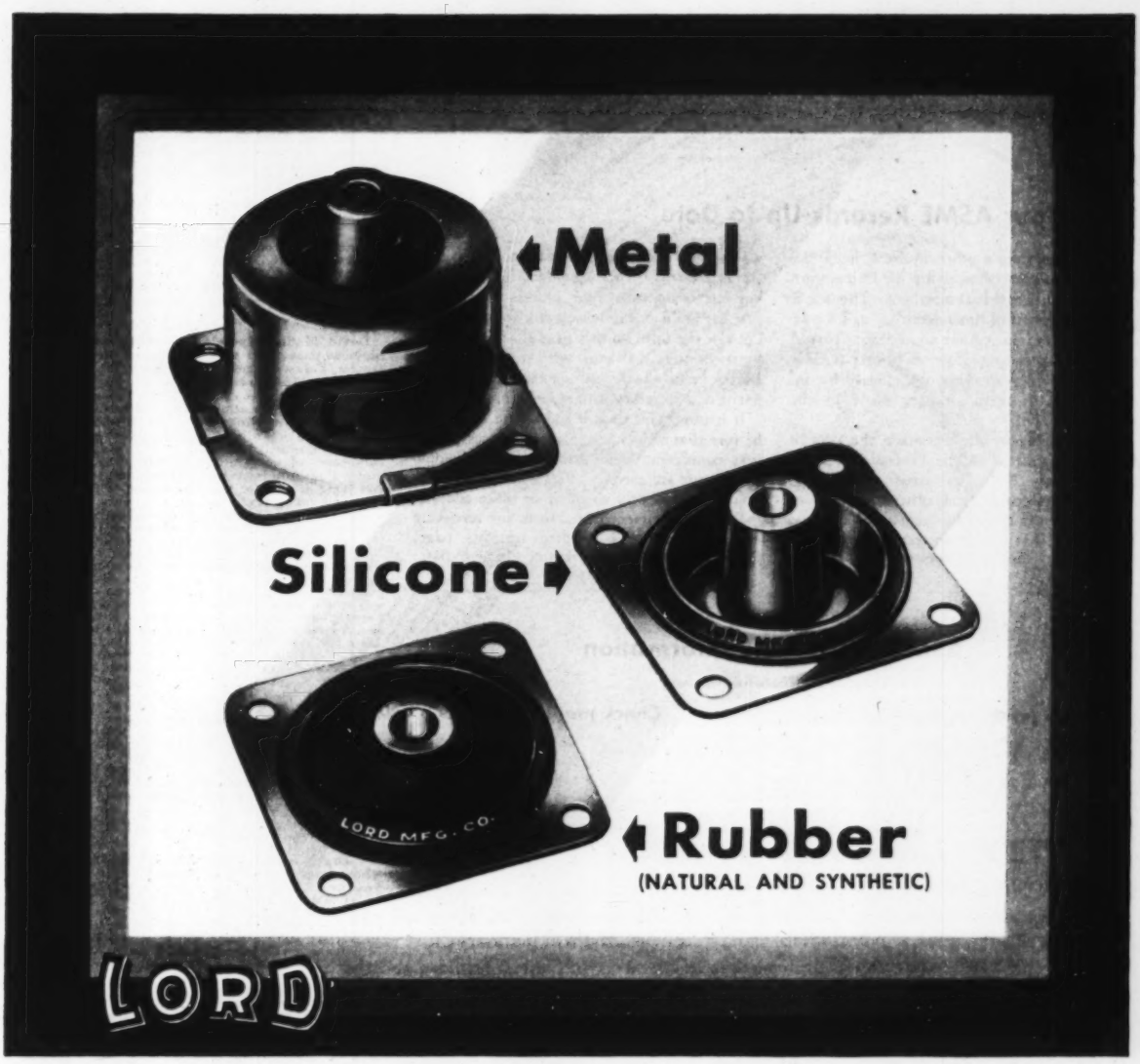
George Grundy Hollins (1883–1954), chief mechanical engineer, The J. G. White Engineering Corp., New York, N. Y., died Jan. 24, 1954. Born, Montclair, N. J., Feb. 15, 1883. Parents, William M. and Adeline (Grundy) Hollins. Education, ME, Stevens Institute of Technology, 1904. Married Mary S. Cooke, 1910 (deceased). Mem. ASME, 1921; Fellow ASME, 1944. Author of several articles on power supply, refrigeration, explosives, and heavy chemicals published in various journals. Survived by son, Dr. George G., Jr., Norfolk, Va.; daughter, Mollie S. Hollins, Montclair, N. J.

James Kantor (1893–1953), consulting engineer, The Liquid Carbonic Corp., Chicago, Ill., died in November, 1953. Born, Chicago, Ill., Aug. 24, 1893. Parents, Charles and Augusta Kantor. Education, BS, University of Illinois, 1916. Married Irene Cootey, 1923; son, James C. Mem. ASME, 1940. Author of many technical articles on bottling equipment; also held more than 100 U. S. and foreign patents on this type of equipment.

Daniel R. Lyon (1904–1954), industrial specialist, U. S. Army, Corps of Engineers, Office of the District Engineer, Chicago, Ill., died Jan. 3, 1954. Born, Chicago, Ill., July 10, 1904. Parents, Daniel I. and Marie (Robbel) Lyon. Education, BS(ME), University of Illinois, 1928; MA(IE), New York University, 1933. Married Leta Southworth, 1931. Mem. ASME, 1945. Survived by wife; a daughter, Leta J.; and a son, Daniel F.

Willard Blakeslee McBurney, Sr. (1885–1953), owner, McBurney Stoker and Equipment Co., Atlanta, Ga., died March 29, 1953. Born, Jersey City, N. J., June 30, 1885. Parents, H. D. and Ada (Woolley) McBurney. Education, ME, Stevens Institute of Technology, 1907. Married Nannette Griffith, 1928; children, Willard, Jr.,

(*ASME News continued on page 398*)



Recommends Materials Best Adapted to your Vibration Control Requirements

Metal—Natural Rubber—Silicone—Neoprene—Buna S—Buna N—and others are selected by LORD Engineers to satisfy your specific environmental conditions and assure the most economical solution of your vibration control problem.

LORD research is constantly developing and evaluating new materials and processes to insure that the most complete line of vibration control mountings is at your disposal.

LOS ANGELES 28, CALIFORNIA, 7046 Hollywood Blvd. · DALLAS, TEXAS, 313 Fidelity Union Life Building · PHILADELPHIA 7, PENNSYLVANIA, 725 Widener Building · DAYTON 2, OHIO, 410 West First Street

DETROIT 2, MICHIGAN, 311 Curtis Building · NEW YORK 16, NEW YORK, 280 Madison Avenue · CHICAGO 11, ILLINOIS, 520 N. Michigan Ave. · CLEVELAND 15, OHIO, 811 Hanna Building

LORD MANUFACTURING COMPANY • ERIE, PA.

Over 27,000 basic designs and their variations are already available from which to choose.

LORD

Headquarters for
VIBRATION CONTROL

Helen N., Olivia A. Mem. ASME, 1941. He held patents on McBurney Stokers.

Harold Conrad McCracken (1927–1953), engineer of Douglaston, L. I., was killed in an automobile accident Dec. 4, 1953. Born, New York, N. Y., Sept. 20, 1927. Education, BSME, Duke University, 1950. Jun. ASME, 1950.

Keep Your ASME Records Up to Date

ASME Secretary's office in New York depends on a master membership file to maintain contact with individual members. This file is referred to dozens of times every day as a source of information important to the Society and to the members involved. All other Society records and files are kept up to date by incorporating in them changes made in the master file.

From the master file are made the lists of members registered in the Professional Divisions. Many Divisions issue newsletters, notices of meetings, and other materials of specific interest to persons registered in these Divisions. If you wish to receive such information, you should be registered in the Divisions (no more than three) in which you are interested. Your membership card bears key letters opposite your address which indicate the Divisions in which you are registered. Consult the form on this page for the meaning of the letters. If you wish to change the Divisions in which you are registered, please notify the Secretary's office.

It is important to you and to the Society to be sure that your latest mailing address, business connection, and Professional Divisions' enrollment are correct. Please check whether you wish mail sent to home or office address.

For your convenience a form for reporting this information is printed on this page. Please use it to keep the master file up to date.

ASME Master-File Information

(Not for use of student members)

Please print **Check mailing address**

Name..... (Last, First, Middle)

Home address..... (Street, City, Zone, State) ☐

Name of employer.....

Address of employer..... (Street, City, Zone, State) ☐

Product or service of company.....

Title of position held.....

Nature of work done.....

I am a subscriber to (please check)

Publication	*Address changes effective when received prior to:*
☐ Mechanical Engineering	10th of preceding month
☐ Transactions of the ASME	20th of preceding month
☐ *Journal of Applied Mechanics*	20th of preceding month
☐ *Applied Mechanics Reviews*	1st of preceding month

Please register me in three Professional Divisions as checked:

☐ A—Aviation	☐ J—Metals Engineering	☐ S—Power
☐ B—Applied Mechanics	☐ K—Heat Transfer	☐ T—Textile
☐ C—Management	☐ L—Process Industries	☐ V—Gas Turbine Power
☐ D—Materials Handling	☐ M—Production Engineering	☐ W—Wood Industries
☐ E—Oil and Gas Power	☐ N—Machine Design	☐ Y—Rubber & Plastics
☐ F—Fuels	☐ P—Petroleum	☐ Z—Instruments and Regulators
☐ G—Safety	☐ R—Railroad	
☐ H—Hydraulics		

Thomas Moolhuyzen (1887–1953?), consulting and sales engineer, Thomas Moolhuyzen Co., Paterson, N. J., died recently, according to a notice received by the Society. Born, Amsterdam, The Netherlands, Aug. 30, 1887. Parents, Thomas and Gerdina Moolhuyzen. Education, graduate, marine-engineering school, Amsterdam, 1906. Married Emilia Voto, 1931. Mem. ASME, 1922.

Robert Samuel Mudge (1911–1953), president and general manager Palo-Myers, Inc., New York, N. Y., died Nov. 17, 1953. Born, South Manchester, Conn., April 18, 1911. Parents, Robert S. and Marion A. (Cudlup) Mudge. Education, ME, Stevens Institute, 1932. Married Christina Van Der Heide, 1943. Jun. ASME, 1935. Survived by wife; a daughter, Marion A.; and his mother.

David Moffat Myers (1879–1954), consulting engineer, associated with the firm of Seelye, Stevenson, Value & Knecht, New York, N. Y., died Jan. 20, 1954. Born, Owasco, N. Y., Jan. 8, 1879. Parents, Rev. Alfred E. and Mary (Moffat) Myers. Education, ME, Columbia Engineering School of Mines, 1901. Married Emily N. Huyck, 1911 (died 1912). Married 2nd, Jennette Kennedy. During World War I, as a volunteer advisory engineer with the United States Fuel Administration, he organized national and state groups for the supervision of fuel consumption at private industrial plants. About 25-million tons of coal were saved without curtailing the production of industry or railroads. He invented the furnaces for special fuels and Aquaknot speed indicator for boats, also sail-slide guide; original work on combustion theory and application in furnace designs for special purposes. Author of several books on engineering, which were published in 1935; many ASME papers; and reports for various other professional societies and government-agency bulletins. Assoc. ASME, 1907; Mem. ASME, 1912; Fellow ASME, 1938. He organized the Fuels Section of the Society and served as chairman, Meetings and Papers Committee. He was consulting engineer, Bureau of Yards and Docks, U. S. Navy, and for the past eight years, consultant, New York Board of Water Supply. Survived by wife; a sister, Susanna Myers, and two brothers, the Rev. James Myers and Alfred S. Myers.

Joseph James Root, Jr., (1883–1953?), vice-president, mechanical department, Union Tank Car Co., Chicago, Ill., died, according to a notice received by the Society. Born, Troy, N. Y., May 3, 1883. Education, BS, Cooper Union, 1909. Mem. ASME, 1914.

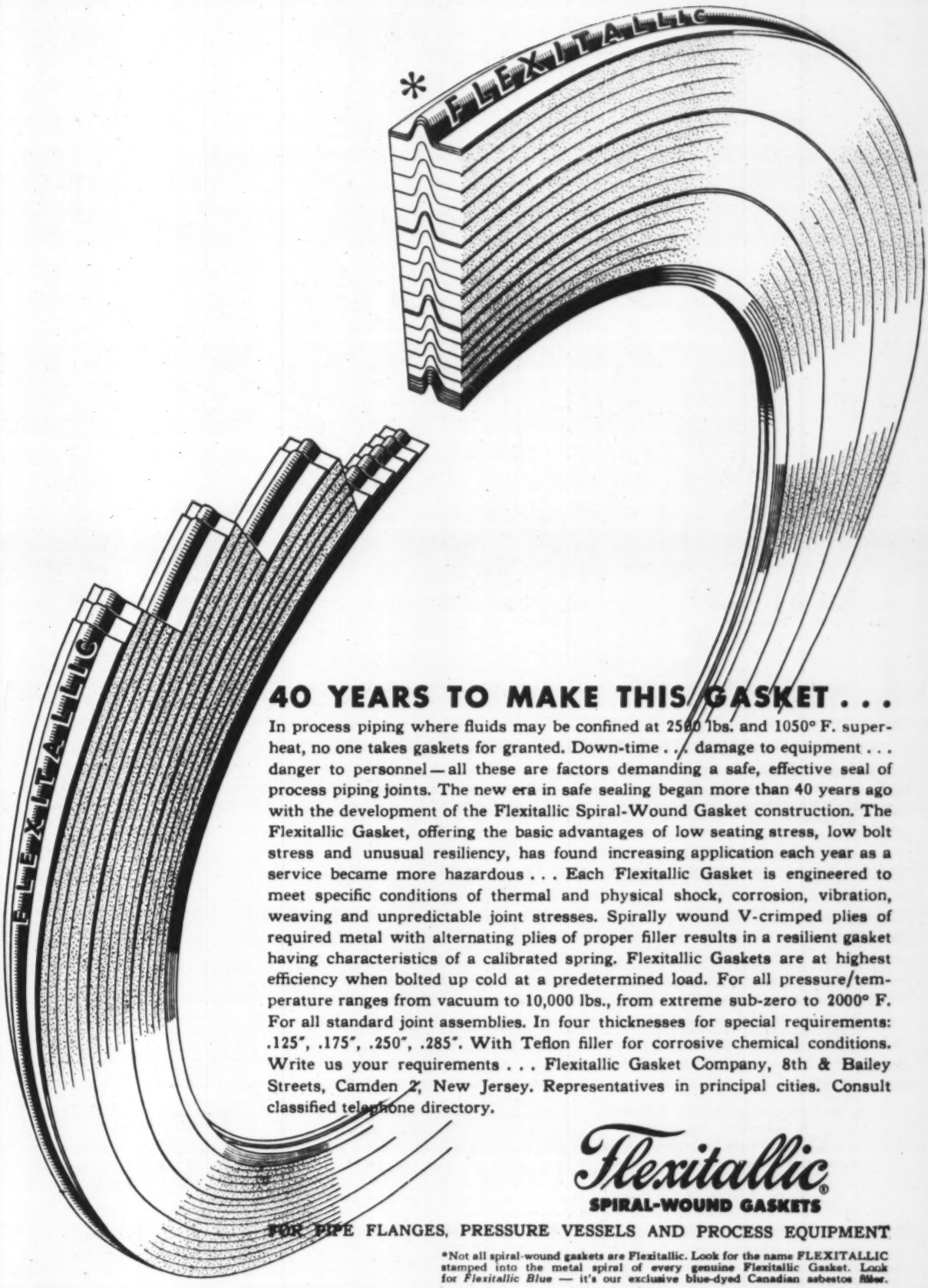
George Glass Shallenberger (1892–1953?), whose death was recently reported to the Society, was head of the firm of George G. Shallenberger, Tulsa, Okla. Born, Pittsburgh, Pa., Feb. 19, 1892. Parents, Frank E. and Bella (Glass) Shallenberger. Education, attended Oklahoma University and Carnegie Institute of Technology. Married Elizabeth McConahey, 1919; daughter Sybel. Assoc-Mem. ASME, 1919; Mem. ASME, 1935.

Jean Russell Shannon (1891–1953?), design engineer, Four Wheel Drive Auto Co., Clintonville, Wis., died, according to a notice recently received by the Society. Born, Brandon, Wis., July 12, 1891. Education, graduate, Stout Institute, 1912. Author of several articles on snow-removal equipment; also held patents on various snow-removal apparatuses. Mem. ASME, 1949.

Oliver Hobson Smith (1890–1954), manager, gas production, Consolidated Edison Co. of New York, Inc., New York, N. Y., died Jan. 27, 1954. Born, Pottstown, Pa., March 16, 1890. Parents, the Rev. Dr. Oliver P. and Mary (Hobson) Smith. Education, ME, Lehigh University, 1911. Mem. ASME, 1944. Survived by wife, the former Mildred V. Galer of Norfolk, Va., and a daughter, Allison V. Smith, Philadelphia, Pa.

Alix Welch Stanley (1872–1953), former industrialist and president since 1920 of The Stanley Securities Co., New Britain, Conn., died Dec. 27, 1953, at his winter residence in Ponte Vedra Beach, Fla. Born, Brooklyn, N. Y., Feb. 2, 1872. Parents, Frederick N. and Mary (Welch) Stanley. Education, PhB, Sheffield Scientific School, Yale University, 1892. Married Harriet Russell, 1895 (died 1942). Jun. ASME, 1893; Mem. ASME, 1903. He was a Chevalier of the Legion of Honor and a member of the Cercle Interallies, Paris, France.

Everett H. Waldron (1864–1953), purchasing and mechanical engineer, Mt. Hope Finishing Co., North Dighton, Mass., died July 1, 1953. Born, Taunton, Mass., Jan. 21, 1864. Education, public schools in Taunton; special courses in engineering. Married Minerva Phillips (deceased). Mem. ASME, 1920. Survived by four grandchildren.



40 YEARS TO MAKE THIS GASKET . . .

In process piping where fluids may be confined at 2500 lbs. and 1050° F. superheat, no one takes gaskets for granted. Down-time . . . damage to equipment . . . danger to personnel — all these are factors demanding a safe, effective seal of process piping joints. The new era in safe sealing began more than 40 years ago with the development of the Flexitallic Spiral-Wound Gasket construction. The Flexitallic Gasket, offering the basic advantages of low seating stress, low bolt stress and unusual resiliency, has found increasing application each year as a service became more hazardous . . . Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally wound V-crimped plies of required metal with alternating plies of proper filler results in a resilient gasket having characteristics of a calibrated spring. Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 10,000 lbs., from extreme sub-zero to 2000° F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". With Teflon filler for corrosive chemical conditions. Write us your requirements . . . Flexitallic Gasket Company, 8th & Bailey Streets, Camden 2, New Jersey. Representatives in principal cities. Consult classified telephone directory.

Flexitallic®
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Not all spiral-wound gaskets are Flexitallic. Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket. Look for *Flexitallic Blue* — it's our exclusive blue-dyed Canadian asbestos filler.

JENKINS PRACTICAL PIPING LAYOUTS 72

Diagram by Huxley Madeheim, Consulting Engineer
Copyright, 1954 — Jenkins Bros.

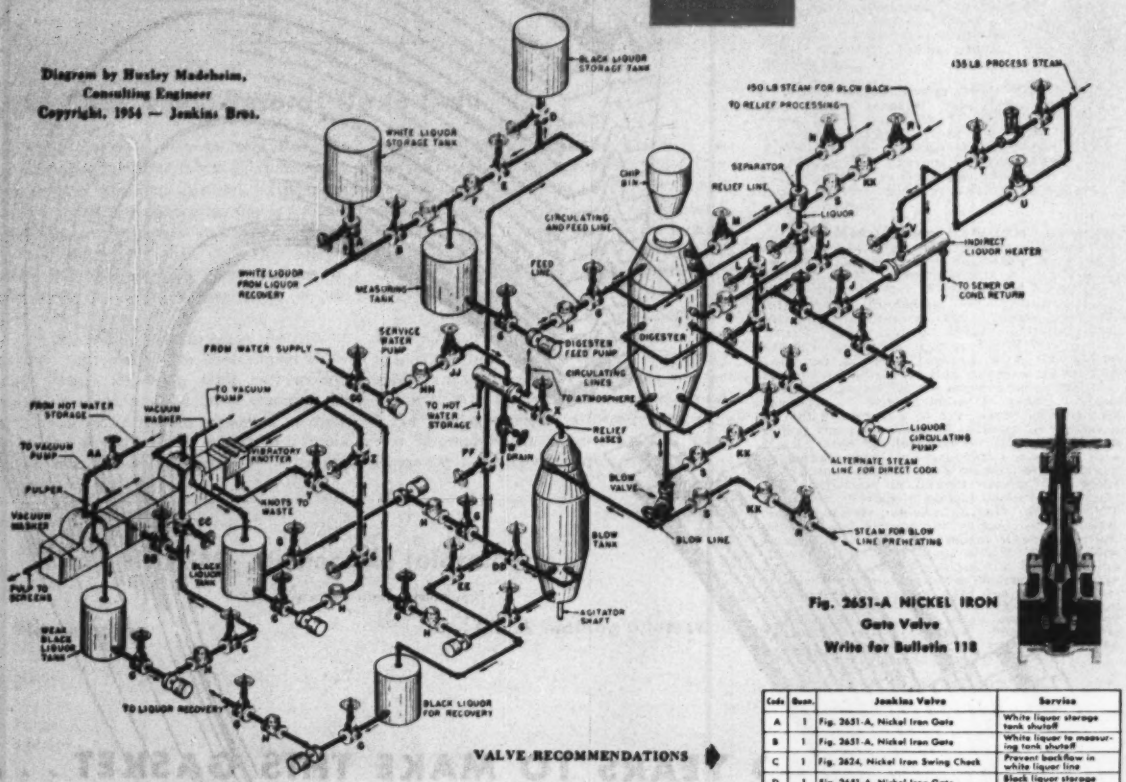


Fig. 2651-A NICKEL IRON Gate Valve
Write for Bulletin 118

VALVE RECOMMENDATIONS

Code	Quan.	Jenkins Valve	Service
A	1	Fig. 2651-A, Nickel Iron Gate	White liquor storage tank shutoff
B	1	Fig. 2651-A, Nickel Iron Gate	White liquor to measuring tank shutoff
C	1	Fig. 2624, Nickel Iron Swing Check	Prevent backflow in white liquor line
D	1	Fig. 2651-A, Nickel Iron Gate	Black liquor storage tank shutoff
E	1	Fig. 2651-A, Nickel Iron Gate	Shutoff black liquor to measuring tank
F	1	Fig. 2624, Nickel Iron Swing Check	Prevent backflow in black liquor line
G	14	Fig. 2651-A, Nickel Iron Gate	Liquor Pump shutoff
H	7	Fig. 2624, Nickel Iron Swing Check	Prevent backflow through pump
J	2	Fig. 2651-A, Nickel Iron Gate	Liquor heater shutoff
K	1	Fig. 2651-A, Nickel Iron Gate	Liquor heater bypass
L	2	Fig. 2651-A, Nickel Iron Gate	Liquor circulating line shutoff
M	1	Fig. 1317, Stainless Steel Globe	Digester relief control
N	1	Fig. 1317-A, Stainless Steel Globe	Control flow of relief gas
P	1	Fig. 2651-A, Nickel Iron Gate	Shutoff liquor from separator
Q	1	Fig. 1331, Stainless Steel Swing Check	Prevent backflow to separator
R	2	Fig. 1040, Cast Steel Globe	Control steam flow
S	3	Fig. 1331, Stainless Steel Swing Check	Prevent liquor flow to steam line
T	2	Fig. 1009, Cast Steel Gate	Control valve shutoff
U	1	Fig. 1040, Cast Steel Globe	Control bypass steam
V	2	Fig. 1009, Cast Steel Gate	Steam shutoff
W	1	Fig. 106-A, Bronze Globe	Drain line control
X	1	Fig. 1307-A, Stainless Steel Gate	Blow tank vent shutoff
Y	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to washer pan
Z	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to knotter
AA	1	Fig. 106-A, Bronze Globe	Control water to wash spray
BB	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to pulper
CC	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to wash spray
DD	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to blow tank
EE	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to recovery
FF	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to storage
GG	1	Fig. 651-A, I.B.B.M. Gate	Service water pump shutoff
HH	1	Fig. 624, I.B.B.M. Swing Check	Prevent backflow through pump
JJ	1	Fig. 613, I.B.B.M. Globe	Control water supply
KK	3	Fig. 1023, Cast Steel Swing Check	Steam line check

How to plan a SULPHATE PULPING PROCESS SYSTEM

Chemical treatment begins when chips, conveyed to the digester, are cooked in an alkaline solution of sodium sulphide and caustic soda. The residual spent solution (black liquor) is used in subsequent processing, or is restored to its original state in a chemical recovery cycle. The resultant economy is an important advantage of the sulphate process.

The digester fluid is prepared by combining the alkaline solution, either new or recovered (white liquor), with black liquor from the digester discharge, in a predetermined ratio. This blended liquor is pumped into the digester simultaneously with the chips. A liquor circulating pump thoroughly agitates the mixture, and liquor drawn from the center of the digester bypasses the indirect liquor heater and is returned to the bottom of the digester. When the charge is completed, the digester is closed, and the cooking begins.

An indirect heater is used for cooking in sulphate pulping, generally, to prevent excessive dilution of the liquor. This layout also shows an alternate steam line for direct cooking.

When the cooked mixture is ready for removal, the blow valve is opened and the charge is transferred to the blow tank where it is washed and cooled.

In a series of vacuum washers, the pulp is forced onto revolving drums. As the drum revolves, the pulp is washed by sprays. From the last washer, it goes to the paper making process.

Black liquor collected from the first washer is stored for re-use in the digester, pumped to the blow tank for washing the pulp, or pumped to the recovery cycle for conversion to white liquor. This recovery process will be described in a later Jenkins Layout.

Jenkins Nickel Iron Gates and Checks with Stainless Steel Trim are recommended in this system, for valves in contact with black or white liquor.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To simplify planning, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17. Sold through leading Industrial Distributors everywhere.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Ask for Piping Layout No. 72.

JENKINS VALVES
LOOK FOR THE DIAMOND MARK
SINCE 1864 TRADE JENKINS MARK
Jenkins Bros.

YOUR

New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

Those in industry who are responsible for various phases of plant, machinery, and product design, production, operating and application engineering will find much to interest them in this NEW CATALOGS Guide. Here, reputable manufacturers, most of whom have current advertising in MECHANICAL ENGINEERING and MECHANICAL CATALOG, offer to send you without obligation, their latest literature which is described on pages 43 to 78.

Catalog Index by Products

Abrasives 251
Actuators, Hydraulic 55
Adhesives 174
Aircraft Equipment 97, 341
Aluminum Extrusion 132
Aluminum Forging 44
Analysers, Gas 350

Bearings 117, 375
Bearings, Ball 80, 255, 336
Bearings, Bronze 229, 306, 319
Bearings, Nylon-Lined 143, 249
Bearings, Roller 34, 42, 336
Bearings, Sleeve 416
Bending, Metal 413
Bending, Tube 259
Bits, Screwdriver 435
Blowers 7, 166, 396
Boiler—Water Columns 285
Boilers 133, 209, 332, 351, 391
Boilers, Heating 164
Boilers, Packaged 33
Boilers, Test 92
Books, Technical 76, 265, 433
Boosters, Gas 140
Brakes, Electric 111
Brass, Alloy 17
Broaching Machines 186
Burners 119, 218, 294, 317, 327, 398

Cameras 328
Capacitors 358
Castings 103, 440
Castings, Investment 1, 378
Castings, Magnesium 103
Cements, Iron 90
Chain, Roller 152
Chains 4
Chamfering Machines 298
Chucks, Air-Operated 198
Clutches 240, 312
Clutches, Cam 425
Clutches, Electric 111
Coatings 93, 278
Coatings, Metal 368
Compressors, Air 140
Condensers, Refrigeration 167
Consulting, Mechanical 157
Controls, Automatic 83
Controls, Boiler 283
Controls, Machine Tool 394
Controls, Motor 339, 348
Controls, Motor Speed 165
Controls, Remote 107, 142, 200
Controls, Steam Heating 187
Controls, Strain Gage 50
Controls, Temperature 230
Controls, Thermal 370
Converters, Hot Water 361
Conveyors, Belt 248
Conveyors, Chip 329
Conveyors, Screw 41
Copying Equipment 31, 141
Counters, Electronic 58
Couplings 47, 354
Couplings, Flexible 242, 303, 409, 420
Couplings, Hose 190
Cranes 116
Crushers 280
Cryogenics 157

This April 1954 insertion of NEW CATALOGS GUIDE replaces the regular "Keep Informed" Section for this issue. The "Keep Informed" Section will appear regularly again beginning with the next issue.

Make a selection and indicate on the coupon on page 42 by circling the numbers of the literature described and fill in the balance of the coupon completely, for no literature will be sent if firm connection and position are not given. Mail to—

MECHANICAL ENGINEERING
Advertising Department
29 West 39th Street, New York 18, N. Y.

Help yourself to this useful literature—you incur no obligation when you return the coupon.

Distribution by us to students not included.

Cylinders 198
Cylinders, Air 257
Cylinders, Hydraulic 250, 257
Cylinders, Pneumatic 19

Drafting Equipment 25, 68, 150
Drawing Equipment 183
Drive Adapters 78
Drives 316
Drives, Belt 16
Drives, Power 20
Drums 171
Dust Collectors 207, 223, 423
Dust Control 423

Electronic Test Equipment 106
Evaporators 272
Exhausters 396
Extrusion, Aluminum Impact 132

Fabrication, Metal 45, 216
Fabrication, Steel 222
Fans 7, 57, 124, 166
Fasteners 86, 154, 253, 408
Filters 61, 85, 128
Filters, Oil 237
Fire Extinguishers 99
Fittings, Pipe 59, 71, 264
Fittings, Swivel 430
Fittings, Tube 359
Flexible Metal Hose 406
Floats 292
Flooring 234, 296
Flow Meters 89, 277, 287, 402
Flow Signal Transmitter 102
Force-Measuring Device 412
Forgings 23, 44, 407
Forms, Concrete 172
Framing, Metal 330
Fume Collectors 223
Fume Combustion 8
Furnace Walls 376

Gages 38, 60, 137, 281, 356, 402
Gages, Draft 13
Gages, Liquid Level 115, 287
Gages, Pressure 53
Gas Turbines 105, 189
Gaskets 3, 344
Gear Drives 193
Gearmotors 197, 269, 333, 422
Gear Units 220
Gears 4, 36, 113, 197, 220, 364
Gears, Bevel 331
Gears, Plastic 14
Gears, Reduction 220
Generators, Electric 96
Generators, Gas Turbine 105
Generators, Steam 133, 209, 280
Grating 234, 296
Grinding Machines 138
Grommets 318
Grooving Tools 399

Heat Exchangers 2, 276
Heat Transfer Equipment 349
Heat Treating 395
Heaters, Asphalt 297
Heaters, Circulation 9
Heaters, Direct-Fired 212
Heaters, Electric 9
Heaters, Feedwater 205
Heaters, Hot Water 178, 361
Heaters, Unit 24, 70, 353
Heating Electric 313
Heating Panels 162
Heating Units, Electric 162
Hoists 110, 116, 226

Humidity Controls 337
Hydraulic Fluid 244
Hydraulic Power Equipment 311

Idlers, Belt Conveyor 163
Indicators, Level 208, 418
Induction Heating 410
Inserts, Wire Thread 383
Instruments 10, 32, 46, 67, 87, 126, 176, 247, 266, 270, 291, 322, 427, 436
Insulation 94, 135, 168, 293, 397
Insulation, Pipe 373

Jacks, Worm Gear 66
Joints, Expansion 49
Joints, Swivel 22, 100

Kettles 326
Keys, Woodruff 227

Leak Detector 104
Lettering Machines 146
Lifts, Hydraulic 191
Lock Nuts 79, 321
Lock Washers 408
Lubricants 170
Lubrication 40, 136, 219, 345, 381, 388, 437

Machine Tools 202, 310, 315
Magnets 181
Manometers 176, 314
Marking Equipment 271, 424
Materials Handling Equipment 123, 195, 431
Metal Alloys 225
Metal-Working Equipment 307
Metals, Thermostatic 386
Meters 35, 283
Meters, Liquid 211
Milling Cutters 184
Mixers 326
Motors, Electric 96, 179, 258, 284, 288, 302, 305, 414, 429
Motors, Hydraulic 379

Nickel Alloys 262
Nozzles 243

O-Rings 82, 129, 153
Oiling Devices 237
Oscillographs 204
Oscilloscopes 74

Packings 3, 405
Panels, Structural 304
Pencils 175
Pens, Drawing 112
Pillow Blocks 101
Pilots, Gas 48
Pipe 246
Pipe Hangers 159, 377, 385, 390
Pipe Linings 169

Continued on Page 42

Use Coupon on Page 42

CATALOG ITEMS Start on Page 43 and Run to Page 78 Inclusive

YOUR

New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

Pipe, Plastic 201, 246
Piping 18, 29, 45, 59, 192, 389
Piping Design 18
Piston Rings 144
Plant Layout Systems 158
Plastic Molding 254
Plastics 254, 323
Plug Nuts 236
Power Plant, Gas Turbine 189
Power and Processing Equipment 248
Precipitators, Electronic 238, 299
Precision Tools 426
Presses 28
Pressure Vessels 326, 380, 389
Pulverizers 221
Pumps 39, 108, 121, 140, 149, 224, 233, 282, 357, 360
Pumps, Centrifugal 252
Pumps, Circulating 334
Pumps, Hydraulic 26, 77, 268, 379, 439
Pumps, Screw 131
Pumps, Sewage 415
Pumps, Sump 428
Pumps, Turbine 313, 419
Pumps, Vacuum 140, 434
Recorders 65, 260, 291, 322, 350
Recorders, Analyzers 263
Recorders, Time 374
Reducers, Gear 180

CATALOG ITEMS
Start on next page

Mail This COUPON Today

MECHANICAL ENGINEERING, 29 West 39th St., New York 18, N. Y.

Date .....

Please send me without cost or obligation the literature indicated by the following circled numbers which appear in "Your NEW CATALOGS Guide" in the April 1954 issue. (Requests limited to 25 catalogs)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195
196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
271	272	273	274	275	276	277	278	279	280	281	282	283	284	285
286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
301	302	303	304	305	306	307	308	309	310	311	312	313	314	315
316	317	318	319	320	321	322	323	324	325	326	327	328	329	330
331	332	333	334	335	336	337	338	339	340	341	342	343	344	345
346	347	348	349	350	351	352	353	354	355	356	357	358	359	360
361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
376	377	378	379	380	381	382	383	384	385	386	387	388	389	390
391	392	393	394	395	396	397	398	399	400	401	402	403	404	405
406	407	408	409	410	411	412	413	414	415	416	417	418	419	420
421	422	423	424	425	426	427	428	429	430	431	432	433	434	435
436	437	438	439	440	441									

Firm Connection and Occupation Must Be Given
(Service not Available to Students)

PLEASE CHECK
☐ ASME Member
☐ Non-Member

Name .....

Position .....

Company .....

Address .....

4-54

NOT GOOD AFTER MAY 15, 1954

Reflectoscope, Testing 366
Refractories 185
Refrigerating Machines 256
Regulators 115
Regulators, Temperature 340, 352
Relays 360
Relays, Electric 301
Rings 408
Rings, Retaining 15
Rivesters 372
Rolling Mill Equipment 194
Rubber 160

Scales 393
Scales, Crane 295
Screw Thread Inserts 139
Screws 154, 441
Seals 151
Seals, Mechanical 43, 151, 320
Separators, Magnetic 231
Shafts, Flexible 274, 384, 403
Shapes, Extruded 213
Shears 21
Silicones 30
Snap Rings 408
Solenoids 286, 325
Soot Blowers 300
Speed Reducers 4, 27, 62, 73, 155, 203, 206, 335
Springs 63, 72, 95, 215, 362, 438
Springs, Coil 72
Sprinkler Systems 290
Sprockets 4, 417
Stampings 63
Steam Accumulators 148
Steel, Stainless 156, 239, 338
Steel, Titanium Carbide 308
Steel, Tool 120, 232, 275
Steels 88, 147, 173, 210, 239, 432
Steels, High Strength 88
Stokers 347, 391
Stokers, Incinerator 145
Stop Watches 196
Strainers 237
Strapping, Steel 261
Structures, Sheet Metal 228
Switches, Electric 360
Switches, Waterproof 370

Tables, Feed 214
Tags, Metal 127
Tanks 122, 125, 326
Tapping Precision 182
Templet Filing 422
Templets, Layout 109
Thermistors 56
Thermometers 137, 291
Timing Systems 65
Tools 60
Torque Limiter 245
Torque Testers 404
Transmissions 77, 197, 235
Transmissions, Power 4
Traps, Steam 93, 190, 355
Treads 234, 296
Tube Reducing 177
Tubes, Heat Exchanger 11
Tubing 343, 400, 411
Tubing, Flexible 309
Tubing, Steel 51
Turbines, Gas 105, 189
Turbines, Hydraulic 37
Turbines, Steam 54, 73, 392

V-Belt Drives 367
Valve Control, Remote 387
Valves 5, 6, 12, 52, 64, 69, 84, 114, 115, 118, 161, 188, 267, 273, 324, 346, 371, 382, 401, 421
Valves, Control 217
Valves, Solenoid 52, 365
Vibration Controls 134, 342
Vibration Fatigue 91

Water Conditioning 130
Water Vapor Physics 363
Welding 81, 333, 338
Welding Fluxes 279
Wire Forms 63, 215, 362

YOUR

New Catalogs

GUIDE

1 INVESTMENT CASTINGS

Engineered Precision Casting Co.—Investment castings, how they are cast in all metals, the process of manufacture and the precision to which they can be cast are covered in detail in this 8-page brochure. A variety of examples of intricate cast parts produced in such metals as stainless steel is shown. The manufacturing process is described and illustrated.

2 HEAT EXCHANGERS

American District Steam Co.—Bulletin No. 35-78A deals with instantaneous heaters, hot water units, and standard heat exchangers for heating and cooling. Contains description, selection, dimension, weights, prices, capacities in gallons per minute, pressure drop in feet of water. Description of Type "R" heaters, capacity tables for Type "E", Type "C", Type "EC", swimming pool and booster heaters, piping arrangement, flow of water tables.

3 TEFLON GASKETS AND PACKINGS

Crane Packing Co.—Bulletin covers "Chemlon" trade name for gaskets and packings fabricated from Teflon. Describes properties, uses as packings, gaskets, electronic insulation, non-stick uses. Also covers C-V rings, braided packings, molded packings, extruded Teflon rod and tubing, molded forms and tape and products for general industrial application.

4 POWER TRANSMISSION

Boston Gear Works—A 384-page tabindexed textbook lists 101 power transmission groups of items immediately available from stock. These include gears, speed reducers, chains and sprockets, pulleys, couplings, universal joints, etc. Thirty pages of essential engineering data are included to simplify drive calculations.

5 PRESSURE SWITCHES AND VALVES

Barksdale Valves—Catalog 3G gives information on "Shear-Seal" Valves, manual and solenoid operated, pressures 250, 1500, 3000, and 6000 psi (manual valves only); shut-off and selector flow patterns. Crescent solenoid-operated, pilot-controlled air valves to 150 psi, diaphragm, bourdon tube, and piston pressure switches for operation on vacuum or pressures to 12,000 psi are included.

6 VALVES

Golden Anderson Valve Specialty Co.—A combination of several bulletins describing the various types of valves. Deals with water, steam, float control, water pressure reducing, altitude control surge relief, solenoid, swing check, hydraulic coke quenching, non return, automatic engine stop, hydraulic check, steam pressure and unloading valves. Fully illustrated with diagram and tables.

7 FANS AND BLOWERS

Chelsea Fan & Blower Co.—Catalog No. 600 describes the comprehensive line of ventilation equipment for industry, farm, and home. Detailed specifications on all fans are included. For attic fans, recommendations for installation can be found on the respective pages. A 4-page Bulletin No. 450 is available, on special application, describing in detail the selection and installation of the proper fan in industry and home.

8 CATALYTIC COMBUSTION

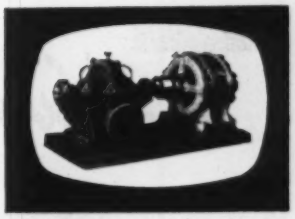
Catalytic Combustion Corp.—Reprints of three articles on heat recovery and fume disposal reveal many uses for catalysts in metal-working, foundry, plastics, rubber, chemical, electrical, and paint industries. "Catalytic Energy Recuperation for Industrial Process Heating" discussed new opportunities for reducing fuel costs by recovery of latent energy from exhaust vapors. "Catalytic Combustion of Core Oven Fumes" describes operating results from catalytic fume disposal on foundry core ovens. "Catalysts Eliminate Fumes, Odors and Combustible Condensate" covers essential design considerations and applications for which Catalytic Fume Combustion may be used.

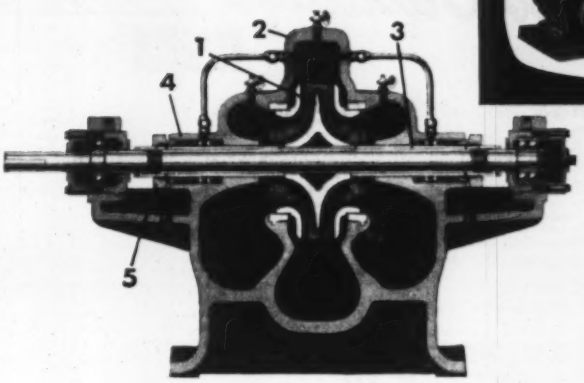
9 CIRCULATION HEATERS

Edwin L. Wiegand Co.—Bulletin 701 describes and illustrates the advantages and typical applications of a line of automatic electric circulation heaters. These units are available for controlled heating of water, oils, heat-transfer media, steam, and air and other gases.

Continued on Page 44

GOULDS Fig. 3450—Single-stage centrifugal pump; Capacities up to 15,000 G.P.M. Heads up to 500 ft.





These **5** *features mean*

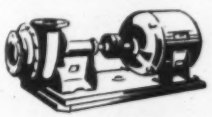
HIGH PUMPING EFFICIENCY
LOW MAINTENANCE COST
LONG SERVICE LIFE

Whenever you need a pump for *general water supply, in-plant circulation of liquids, booster service or low pressure boiler feeding*, check the economy features these sturdy Goulds single-stage centrifugal pumps offer.

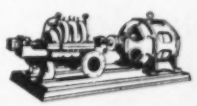
1. **Hydraulically balanced impellers** assure freedom from vibration.
2. **Horizontally split casing,** matched and dowelled, makes access to working parts easy. All water passages exceptionally smooth due to careful core making.
3. **Heavy bronze shaft sleeve** ground to smooth finish reduces friction. Saves power. Reduces wear on packing.
4. **Deep stuffing box** and bronze water seal ring minimize chance of leakage.
5. **Gland horizontally split and bolted** to make repacking easy.

These pumps are available in all-iron or all-bronze construction, as well as standard bronze fitted. Maximum interchangeability of parts keeps inventories at a minimum. For complete details and specifications call your Goulds representative or send for Bulletin 721.2.

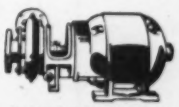
Other GOULDS PUMPS for power and plant services



GOULDS Fig. 3169
Single stage centrifugals for general processing purposes. Capacities to 1100 G.P.M. Heads to 180 ft.



GOULDS Fig. 3330
Multi-stage centrifugal pumps for boiler feed and pressure service. Capacities 40 to 2000 G.P.M. Heads to 850 ft. Bulletin 722.1.



GOULDS Fig. 3650
"Close-coupled" single-stage centrifugal for general industrial use. Capacities to 2000 G.P.M. Heads to 400 ft. Bulletin 710.1.

MEMBER

Goulds PUMPS INC.
Seneca Falls
New York

YOUR

New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

10 INDUSTRIAL ELECTRONIC INSTRUMENTATION

Beckman Instruments, Inc., Berkeley Div.—A 16-page, 3-color bulletin describes the features and applications of the Berkeley line of industrial electronic counters, timers, other instruments, and accessories. Their Engineering Dept. is designing some new units to apply the technique of decimal presentation which is expected to reduce operating time on certain work. Other designs will extend the measurement range and versatility of Berkeley instruments.

11 ALUMINUM HEAT EXCHANGER TUBES

Aluminum Co. of America—Illustrated catalog contains relevant data on Alcoa aluminum heat exchanger tubes. Covers advantages, fabrication, application in petroleum and petrochemical industries, chemical, steam, atmospheric, air and gas. Also use of aluminum alloys, fluid flow characteristics, heat transfer characteristics, specifications and data with tables.

12 CHECK VALVES FOR COMPRESSORS

Pennsylvania Pump & Compressor Co.—Bulletin 509-DD describes Airchek valves for installation in the discharge lines of air and gas compressors where they serve to damp pulsations, also add long-life and freedom from maintenance.

13 INCLINED TUBE DRAFT GAGES

Ellison Draft Gage Co.—Bulletin 109A describes inclined tube draft gages, stationary, portable and laboratory type. Constant zero under wide ranges in room temperature. Level and tube replaceable in field. Also describes Pitot tubes for use with these draft gages. Gives suggestions for use and other data.

14 PLASTIC GEARS

Westinghouse Electric Corp.—Micarta phenolic laminate gear material for silent gear operation, claiming tooth deflection 30 times that of steel, is covered in 16-page book No. B4661 complete with design tables and formulas along with application and machining information.

15 RETAINING RINGS

Waldes Kohinoor, Inc.—Their 52-page catalog covers Waldes Truarc retaining rings, including 28 pages of engineering and specification charts, 6 pages of field applications and case histories, 18 pages devoted to Truarc pliers, assembly, and accessory tools, and other relevant information pertaining to the most advantageous use and selection of Truarc retaining rings.

16 V-BELT DRIVES

Allis-Chalmers Mfg. Co.—Bulletin 20B6051 carries the procedure for figuring "Texrope" V-belt drives by means of tables, together with examples of how to use the engineering information given. The bulletin also describes "Texrope" belts, sheaves, and speed changers.

17 BRASS ALLOY

American Brass Co.—"Formbrite" is a fine-grain brass alloy described in Publication B-39, which gives some of its industrial applications and advantages. Advantages claimed for the metal are strength, hardness, springiness, and surface superior to ordinary drawing brasses.

18 PIPING SYSTEMS REGULATIONS

Pipe Fabrication Institute—Technical Bulletin TB1-1953 furnishes advisory information on pressure-temperature ratings of plain end pipe used in power plant piping systems. Ratings cover seamless carbon steel pipe, in various grades, seamless carbon-molybdenum steel pipe, seamless chromium-molybdenum all steel pipe, seamless chromium-silicon-molybdenum alloy steel pipe. Table of chemical requirements and nominal weights (lb. per ft.) of plain end seamless carbon and alloy steel pipe.

19 PNEUMATIC CYLINDERS

Westinghouse Air Brake Co.—Bulletin 9308-2 of Industrial Products Division describes pneumatic cylinders. Advantages of streamlined barrel construction are pointed up as is method of ordering with specifications and dimension tables. Shown with foot, flange and swivel mounting kit. Data for selection of cylinder levers and mounting parts reference.

20 ELECTRIC POWER DRIVES

Sterling Electric Motors, Inc.—20-page illustrated catalog contains complete descriptive information on variable speed drives, geared motors and constant normal speed motors in drip-proof, splash-proof, totally enclosed and pipe ventilated designs.

21 SHEAR SELECTION

O'Neil-Irwin Mfg. Co.—Faster, easier ways of selecting, setting up and operating Di-Acro shears are described and illustrated in a new 14-page booklet. Booklet points out many different materials that can be sheared: plastics, fiber, mica, leather and rubber to heavy gauges of aluminum, chrome molybdenum, leaded brass, stainless steel and other spring tempered materials. Specifications and capacities are listed in tables on four hand and four power operated precision shears with material capacity of 16 gauge mild sheet steel.

22 ROTARY STEAM JOINTS

Seamlex Co.—Four principal steps required for the selection of the type of rotary joint most efficient under given working conditions are described in Bulletin 5020. Table I classifies rotary joints according to maximum pressures and temperatures; Table II identifies various operating conditions; and Table III lists the standard types of rotary joints available for specific applications.

23 FORGINGS

United States Steel Corp.—A 28-page booklet "USS Quality Forgings Fully Prepared to Do the Tougher Job," illustrates and describes the forging of generator, turbine, and waterwheel forgings, anvil bases and columns, forged shafts, forged steel rolls and sleeves, and forged blooms, billets, and rounds. The booklet closes with a brief history of forging.

24 VENTILATING-HEATING UNITS

Trane Co.—"Unit Ventilators," Bulletin DS-340 shows the Trane Unit Ventilator system with wall-to-wall kinetic barrier action, as well as conventional Unit Ventilators. Construction, mechanical, and architectural specification are given. Also included are illustrations of cycles of operation, roughing-in dimensions, application suggestions, and both hot-water and steam capacities.

25 DRAWING PENCILS

A. W. Faber-Castell Pencil Co.—An illustrated booklet describes the advantages of Castell pencils and shows the relative shading of each of the 20 available grades. A chart shows the recommended first, second, and third requirements of different hardnesses of lead for different drawing and sketching activities in construction, industry, architecture, and surveying.

26 HYDRAULIC VANE PUMP

Denison Engineering Co.—Bulletin P-5 fully describes new Pump/Motor, which is usable as either pump or motor without alterations of any kind. Designed for use up to 2000 psi, the Pump/Motor is completely radially balanced. Interchangeable cam rings offer eleven different pumping capacities from 3 to 82 gpm, plus motor torque ratings from 13 to 257 in.-lb per 100 psi.

27 RIGHT-ANGLE GEAR SPEED REDUCER

D. O. James Gear Mfg. Co.—Catalog 42-B gives over 84 illustrated pages of data on Right-Angle Gear Speed Reducers using parallel and vertical drives with ratios from 1:1 to 1100:1 and rating

Everybody knows this sign

stands for money

...and smart gear buyers

know this sign CINTI stands for

the best in custom gears.

CINTI "Gears...Good Gears Only"

THE CINCINNATI GEAR CO. • CINCINNATI 27, OHIO

YOUR

New Catalogs

LATEST INDUSTRIAL LITERATURE

GUIDE

form 0.14 hp to 350 hp. Specifications and recommended practice for selection are included.

28 EXTRUSION & DIE FORGING PRESSES

Loewy Construction Co.—Brochure, "Past and Present Developments and Advances in Hydraulic Press Manufacturing Methods." An illustrated description of the techniques and advantages of fabricating metal shapes by plastic forming, using extrusion, die forging, and deep drawing presses.

29 PIPING DESIGN

Blaw-Knox Construction Co., Power Piping Div.—The design of piping for flexibility with Flex-Anal Charts is covered in an 86-page book. It fills the need for the flexibility analysis of any piping system. It is intended for the experienced pipe designer who can, by use of this method and the application of Flex-Anal Charts, accurately analyze most piping systems in a few hours which formerly required days and even weeks. Many tables, Flex-Anal Charts, and typical piping layouts are included.

30 SILICONES

Dow Corning Corp.—"A Reference Guide to Dow Corning Silicone Products" is a new general catalog which lists over 50 different Dow Corning Silicones according to their physical form and applications. Important properties for each product and code numbers for obtaining more information about any particular product are presented in this 4-page bulletin.

31 PHOTOCOPYING EQUIPMENT

Peerless Photo Products, Inc.—A 6-page color brochure illustrates new Dri-Stat transfer-process photocopying equipment and materials. Describes new flat-bed printer, used to expose original matter with Dri-Stat #1 paper, and two models of separate processing unit for positive copy. Also describes combination rotary printer and processer. Other bulletins describe "Magic Hand" a vacuum blanket printer and Neo-Flow reducing camera.

32 INSTRUMENTS

Consolidated Engineering Corp.—New general catalog describes "Electromechanical" instrument systems for automatic measurement and recording of physical variables, such as pressure, vibration, acceleration, stress, strain, temperature, etc. Systems record up to 36 high-speed physical variables simultaneously. All instruments are described briefly and specific technical bulletins are listed on each.

33 SELF-CONTAINED BOILERS

Cleaver-Brooks Co.—Boiler Catalog No. AD-100 includes complete description of the Self-Contained LR Boilers for heating and processing. The catalog lists features, shows typical applications, covers design, construction, and efficiency, and contains charts on capacities and dimensions. Back cover contains complete list of sales representatives handling and servicing Cleaver-Brooks Self-Contained Boilers.

34 SPHERICAL ROLLER BEARINGS

SKF Industries, Inc.—An improved internal design in its spherical roller bearings is described in a 12-page bulletin. The improvement, available in the Series 222 and 223 bearings, is claimed to increase bearing capacity 25 to 50 per cent and service life $2^1/_2$ to 3 times. The new design accomplishes roller guiding by a separate ring, which permits longer rollers because of the elimination of integral inner ring flanges and adjacent grinding undercuts. A "window"-type cage is used. Sizes and specifications, with life-expectancy and load-ratio nomograms, are included.

35 INDUSTRIAL METER SELECTION

Rockwell Mfg. Co.—A new bulletin, No. OG-400, intended to guide the proper selection of meters for measuring more than 200 chemicals, petroleum products, and other liquids with varying corrosive characteristics, is available. In addition to the complete table of metered liquids matched with case, chamber, and piston specifications, the bulletin also includes a simplified specification sheet which makes it easy for the customer to cover all necessary operating requirements so that proper meter recommendations can be made at the factory.

36 STAMPED GEARS

Winzeler Mfg. & Tool Co.—A 4-page illustrated booklet gives gear data and specifications including tables of tooth parts, calculation of diametral pitch, and dimensional listings. It describes the stock line of gears and pinions and describes the facilities available for custom orders on gears, precision tools, dies, fixtures, and gages. Capacity of punch press equipment is from 6 to 100 tons.

37 HYDRAULIC TURBINES

James Leffel & Co.—Two new bulletins tell about recent Leffel hydraulic installations. Bulletin No. 1085 describes the Leffel installation at the Bureau of Reclamation's new Anderson Ranch Dam, with photos, statistics, etc. Bulletin No. 1086 contains information on a Leffel turbine used in the expansion of TVA's Wilbur Dam, with photos, field-test results, cross-section of installation, etc.

38 GAGES

Sheffield Corp.—Catalog 126-53 has 24 pages devoted to Sheffield "Plunjet" Gaging Cartridge. Tells how to design and make your own air gaging and machine controls. Gaging ranges .001 to .040, amplification 125 to 5000 to 1. Describes a type of gaging cartridge used in conjunction with Sheffield Column and Dial Type Precisionaire Gages and other makes. Can be applied to a wide range of gaging, tooling and fixturing. Applications are shown including instructions for selecting, applying and ordering.

39 SELF-PRIMING PUMPS

Jabsco Pump Co.—Leaflet shows rather complete line of self-priming pumps. Illustrated tabular data on standard models, plain and ball bearing. Plastic pump is shown also special pumps and kits. Technical information on liquids that can be handled, temperature range, speeds, pressure, suction lifts, abrasive service. Applications are also shown.

40 FORCE-FEED LUBRICATORS

Frontier Industries, Inc., Manzel Div.—Collection of booklets describes a line of force-feed lubricators for use with all classes of machinery: includes catalogs on Manzel models 25, 82, 94, "X," hp. 20-30 and Spray Lubricators. Also contains details of operation, price lists, ordering specifications, special fittings.

41 SCREW CONVEYER

Link-Belt Co.—The 92-page Book No. 2289 contains detailed engineering data on screw conveyers and screw feeders, with selection tables and horsepower formulas, layouts and arrangements, dimensional data, and installation photographs. One table lists 250 materials and classifies them by size, flowability, abrasiveness, average weight.

42 CYLINDRICAL ROLLER BEARINGS

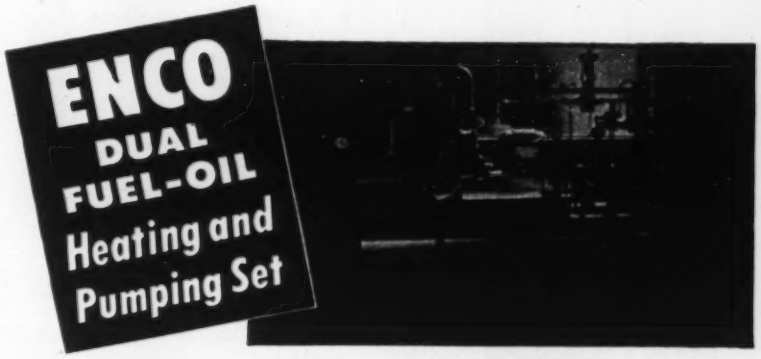
General Motors Corp., Hyatt Bearings Div.—Complete catalog on cylindrical roller bearings giving dimensions, load ratings and application data on six major types of Hyatt roller bearings. Sixty-eight pages, Catalog 150.

43 MECHANICAL SEALS

Byron Jackson Co., Pump Div.—Bulletin No. 153-1000 is condensed from an editorial film which describes and illustrates the history and development of different styles, manufacture, use and maintenance of mechanical seals.

44 ALUMINUM FORGINGS

Aluminum Co. of America.—A 171-page book, "Designing for Alcoa Forgings," outlines forging processes and shows how they affect various problems and principles of design. Recommended forging design proportions are given in tables and illustrated by specific examples.



Two heaters and two pumps—one steam, one electric driven—in one set with these six features:

1. Completely automatic operation with temperature and pressure regulation.
2. All essential equipment—including safety valves as needed—in one compact unit.
3. Individually designed to meet the specific needs of the power plant.
4. All parts visible and accessible for easy operation, maintenance and repair.
5. Pumps run at moderate speed. Heaters designed to give the correct viscosity and velocity without fouling.
6. Cleaner boiler room . . . all overflows connected to a common outlet, flanged drip pan for pumps catches oil drip.

EC490

THE ENGINEER COMPANY

75 WEST STREET, NEW YORK 6, N. Y.

IN CANADA: ROCK UTILITIES LTD., 80 JEAN TALON ST. W., MONTREAL, P. Q.

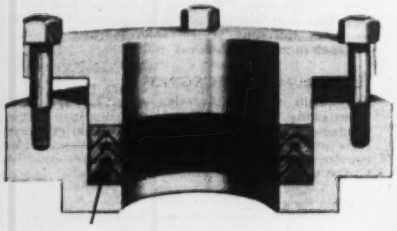
Why users prefer CHEVRON* Packing

for rams, plungers, reciprocating rods

1. Assures a low friction, positive seal

2. Lasts much longer, needs less maintenance than ordinary V-type packing

3. Works efficiently in a shallow stuffing box



Note the exclusive hinge-like construction of CHEVRON packing.

GARLOCK CHEVRON Packing is entirely different from ordinary V-type packings. With *increasing* pressures CHEVRON rings tighten and prevent leakage; with *decreasing* pressures the packing eases off and permits operation with a minimum of friction.

Service reports, such as those below, prove that CHEVRON packing seals better and lasts longer.

▶ On hydraulic press—40" ram, 6,000 p.s.i., ram honed and chrome plated, gland machined to give clearance of .006" between gland and ram. Garlock 431 CHEVRON size 40" x 41½" x only 2" deep gave 14 years service.

▶ On a machine with hydraulically operated clutches—¾" cylinder, maximum pressure 500 p.s.i., service intermittent, maximum travel ¾". First used cups, then "O" rings, neither of which worked well. Now packed with Garlock 431 CHEVRON ⅜" x ¾" x $\frac{11}{32}$" deep and doing a smooth, positive sealing job.

Garlock 431 CHEVRON Packing

Ask your Garlock representative to give you all the cost-saving facts about CHEVRON packing, or write for folder AD-115.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

Sales Offices and Warehouses: Baltimore • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland Denver • Detroit • Houston • Los Angeles • New Orleans • New York City • Palmyra (N. Y.) • Philadelphia Pittsburgh • Portland (Ore.) • Salt Lake City • San Francisco • St. Louis • Seattle • Spokane • Tulsa.

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

*Registered Trademark

GARLOCK

PACKINGS, GASKETS, OIL SEALS, MECHANICAL SEALS

RUBBER EXPANSION JOINTS

45 PIPING FABRICATION AND ERECTION

Dravo Corp.—A 24-page illustrated booklet, Bulletin No. 1700, shows piping installations in steel mills, for gas transmission systems, central power stations, water pumping stations, heating plants, oil refineries, and chemical process plants. Dravo's engineering and fabrication facilities are also illustrated and described.

46 SPEED-MEASURING INSTRUMENTS

James G. Biddle Co.—Bulletin 35-50 describes resonant reed, centrifugal, and chronometric types of speed-measuring instruments, with 28 pages devoted to the selection, operation, and illustration of Frahm, Jagabi, Jones, and Dr. Horn instruments. Also featured are repair and engineering services avaiable.

47 SELF-ALIGNING COUPLINGS

Koppers Co., Inc., Fast's Coupling Dept.—Six-page folder on Fast's self-aligning couplings gives graphic illustrations of principles and features of these couplings; table of utility factors for various kinds of connected machines; and tables of rating for standard forged-steel couplings and heavy-duty-type couplings.

48 GAS PILOTS

North American Mfg. Co.—Gas pilots, manually or electrically ignited are described in Bulletin 151-155. Illustrations, diagrams, specifications, capacities, gas pressure regulators, dimensions, accessories are fully covered in diagram and tabular data together with instructions.

49 EXPANSION-JOINT DESIGN GUIDE

Flexonics Corp.—A 24-page Flexon Expansion Joint Design Guide, Catalog 135, covers engineering application and selection data necessary to the proper solution of pipeline expansion problems. Features of the Flexon Design Guide include a discussion of the various types of expansion joints on the market, the many types of Flexon Expansion Joints available, and types of pipeline motion solved by expansion joints; also expansion joint design considerations, installation instructions, and selection data. The center spread of the catalog is devoted to a schematic piping layout illustrating various expansion joint applications and principles.

50 STRAIN GAGE CONTROL

Hathaway Instrument Co.—For measuring and recording static or dynamic strain, the new MRC-21 strain gage control unit is available with 6, 8 or 12 channels in one case. When used with the proper oscillograph, this equipment will record strain over the frequency range of 0 to 6000 cycles per second. This unit features automatic calibration, high maximum sensitivity, and very low noise level.

51 WELDED STEEL TUBING

Bundy Tubing Co.—"Bundyweld Steel Tubing" has 12 pages of descriptive material covering physical properties, standard and special tubing sizes, recommended fabrication procedures, and applications where Bundyweld has been successfully used. Information is given on fabrication services provided by Bundy.

52 CONTROL VALVES

Valvair Corp.—Bulletin SK-53 describes solenoid pilot operated control valves with emphasis on valve performance. Engineering features fully described in illustration, diagram and tables. Wide range of models and applications shown in illustration. Full details and specifications are included.

53 PRESSURE GAGES

American Chain & Cable Co., Helicoid Gage Div.—The 24-page Helicoid gage catalog describes the Helicoid gage as guaranteed accurate to within ½ of 1 per cent of the total dial graduation over the upper 95 per cent of the 270-deg dial arc. Cut-away photographs and line drawings show the complete line of Helicoid gages.

54 HCB SINGLE STAGE TURBINE

DeLaval Steam Turbine Co.—A six-page bulletin describes design features, dimensions and performance data on new HCB single stage turbine. HCB single stage turbine was designed for a variety of plant applications. Maximum operating conditions of the HCB turbine are: hp to 100, pressure to 300 psig, temp. to 550F, speed to 4000. The bulletin presents a two-page cut-away diagram of the HCB turbine with a descriptive list of 18

YOUR *New Catalogs* GUIDE

design features. Length and width measurements and dimensions of parts are given in line drawings of the HCB turbine. Other information includes performance data and construction materials.

55 RECIPROCATING ROTARY HYDRAULIC ACTUATORS

Bonnot Co.—Bulletin 21 describes and illustrates construction and operating features of a wide range of Hydromotors, trade name for reciprocating rotary actuators. Engineering data and schematic applications are included. The Hydromotor, employing air, oil, or other proper fluid medium, provides equal power in either direction and can be controlled as to speed or arc of travel. It is said to give savings in weight and space through simplification of design.

56 THERMISTORS

General Electric Co., Carboloy Dept.—Technical Data sheets TH-9, discusses thermistors in application to time delay, oil burner circuit and controlled automation. Manufacturing and operating data plus grade selection. TH-10 describes temperature compensation, resistance range, application, advantages. TH-11 deals with contactless switches.

57 FAN EQUIPMENT

Clarage Fan Co.—New Service Manual shows how to properly install, operate, and maintain Clarage fans, blowers, and air conditioning units. Manual contains 68 pages of useful information, valuable to any engineer or maintenance man who has fan problems.

58 PHOTOELECTRIC COUNTER

Photoswitch, Inc.—Bulletin PA506 describes a completely packaged general-purpose photoelectric counter, Photoelectric Counter Set PIC. The set consists of a photoelectric control, light source, and electric counter; remote counting is possible with the device, standard 115-v a-c power is utilized, and counting speed of up to 600 counts per min is claimed.

59 PIPE FITTINGS

Ladish Co.—New 304-page, tabindexed catalog details specification on complete line of controlled quality butt welding fittings, forged ASA, large diameter and TEMA flanges and forged screwed and socket welding fittings. 56-page technical data section features latest provisions of applicable piping codes and standards to assist in solving piping problems.

60 TOOLS

Brown & Sharpe Mfg. Co.—Catalog No. 35 has 224 illustrated pages describing the complete line of Brown & Sharpe Small Tools. This line includes machinists' tools, electronic gaging equipment, Johansson gage blocks, cutters, hobs, arbors and adapters, screw machine tools, pumps, and miscellaneous items.

61 VENTILATION FILTERS

Dollinger Corp.—Model WKE Dry Panel Filters for ventilators and air conditioners are described in Bulletin 600, 8 pages. The Model WKE is available in several sizes, and a table gives capacites and other specifications for each size. Curves showing performance characteristics are given. Information for selection and installation is included.

62 HERRINGBONE SPEED REDUCERS

W. A. Jones Foundry & Machine Co.—Catalog 100 describes in full detail the complete line of herringbone gear drives with capacities up to 1950 hp. Single, double and triple reductions for coupled and overhung load applications. Standard ratios up to 355.8 to 1. Completely antifriction bearing equipped. Detailed application data, new quick selection tables, combined rating tables with dimensions and standard bed plates are featured.

63 COIL SPRINGS, WIRE FORMS, AND METAL STAMPINGS

Dudek & Bock—Bulletin shows how the manufacturer's free design service can save users many dollars. Special instruments developed to take the guesswork out of specifying, inspecting, and testing are described, together with engineering charts and data in easy-to-understand language.

64 VALVES

Kieley & Mueller, Inc.—Catalog CV53 covers line of automatic control valves for process industries.

complete hanger assemblies save your engineering time

For complete information . . . write for your copy of Bulletin No. 54.

You can save many hours of engineering time and speed up your specifications by using Blaw-Knox overhead roller assemblies, rigid hanger assemblies, functional spring hangers with the patented *internal swivel action*, and vibration eliminators.

Each is a complete unit designed for a specific purpose. Constructed to comply with the "code for pressure piping" requirements. Available in types and sizes to meet varying conditions.

And each is ready to install. So you also eliminate expensive cutting, threading and assembling in the field.

Any time you'd like some help, our experienced engineers are available to both design and make recommendations for your hanger requirements.

BLAW-KNOX COMPANY, Power Piping and Sprinkler Div., Pittsburgh 33, Pa.

BLAW-KNOX **PIPE HANGERS**

Complete line of functional spring hangers • rigid hanger assemblies • overhead roller assemblies • supports • vibration eliminators . . . plus complete prefabricated power piping systems

An Invitation To
AERODYNAMICISTS

You may well be one of a select group of men intently interested in developing tomorrow's jet fighters . . . special reconnaisance aircraft . . . jet bombers and transports. The Aircraft Division of Fairchild offers a genuine creative opportunity to such men.

New concepts of flight for the jet era . . . as well as engineering advances on the world-renowned C-119 Flying Boxcar and soon-to-be-produced C-123 Assault Transport are coming from Fairchild. Diversified, stimulating assignments like these increase the inventive challenge to Fairchild's team of qualified aerodynamicists.

Gracious country living only minutes away from urban Baltimore or Washington . . . paid pension plan . . . an excellent salary with paid vacations . . . ideal working conditions . . . generous health, hospitalization and life insurance . . . and the many other benefits of a progressive company add to the pleasure of working with Fairchild.

You'll be investing wisely in a secure future if you take time today to write to Walter Tydon, Chief Engineer, outlining your qualifications. Your correspondence will be kept in strict confidence, of course.

ENGINE AND AIRPLANE CORPORATION
FAIRCHILD
Aircraft Division
HAGERSTOWN, MARYLAND

YOUR *New Catalogs* GUIDE

Available to meet nearly all pressure, temperature and operating requirements encountered in fluid flow control. Also special valves for extraordinary conditions or installations. Fully illustrated with tabular data.

65 ELECTRIC TIMING SYSTEM

Service Recorder Co.—Folder outlining accurate electrical timing devices for industry for recording operational and down time for cost control. Describes and illustrates Model M with features and operation. Can be applied to any type of industrial operation in single or multiple installation.

66 WORM GEAR JACKS

Duff-Norton Mfg. Co.—Leaflet describes "Worm Gear Jack" used for table, machine part, machine leveling adjustments, besides many other germaine uses. Line drawings show a few suggested applications of the jack.

67 CONTROL INSTRUMENTS

Minneapolis-Honeywell Regulator Co.—Catalog 5000 concisely lists line of industrial measuring and controlling instruments. Also covered are panelboards, related instruments and instrument systems. Functional descriptions, illustrations and identification of more exhaustive literature available on each.

68 DRAFTING-MACHINE SCALES

Universal Drafting Machine Corp.—Bulletin gives complete information on the advantages of this extremely accurate, ground from the solid, aluminum scale and in addition provides a valuable chart of 3/4 size actual scale photographs showing all the standard Duraline Scale graduations commonly used by engineers, draftsmen, architects, and designers. It also provides an explanation of scale terminology in general use—to aid buyers when writing for information on specially graduated scales for special uses.

Solve Your Job Problems Faster!

Look over this listing of free catalogs. Then choose those that will be most helpful to you. Fill in coupon on page 42 and mail promptly. America's leading manufacturers make this literature available to you (except students).

New Catalogs GUIDE

69 VALVES

DeZurik Shower Co.—Catalog describes the line of plug valves and contains an extensive list of recommendations of materials for specific fluids, solutions, suspensions, etc. Advantages of DeZurik valves, including the cylinder-operated valve-positioner, are explained. Specifications for pipe-line strainers, gate valves, and cast-steel globe and angle valves are included.

70 REVOLVING UNIT HEATERS

L. J. Wing Mfg. Co.—Bulletin HR-6 describes revolving unit heaters which feature a revolving air-distributor with one or more outlets. Models are available for steam, hot water, and electric and gas heat supply in a full range of sizes. Also can be used for summer cooling. Design and construction details are included.

71 ALLOY STEEL WELDING PIPING SYSTEMS

Key Co.—Pamphlet describes "Key-Kast" alloy welding fittings for piping systems. Uses and advantages. Lists and illustrates various types of fittings, all shapes, sizes and schedules in low and intermediate alloys and stainless steel. Table of various alloys.

72 SPRING ENGINEERING

U. S. Steel Corp., American Steel & Wire Co. Div.—A manual of spring engineering, replete with technical data and descriptive material. Contains general information on springs, materials, design of various types of springs and many tables covering the subject from practically all angles. Illustrated.

73 STEAM TURBINES

Terry Steam Turbine Co.—Bulletins in looseleaf form which cover a complete description of Terry solid wheel turbines with cross section drawings of typical units for both moderate and high steam pressure conditions: a description of the Terry axial flow impulse, both single stage and multi-stage; Terry gears which are used for speed increasing and speed reducing.

74 OSCILLOSCOPE

Technomatic Instrument Co.—Typical applications and specifications are given in this 4-page folder of the Model 21A 21-in. cathode oscilloscope. The instrument is precision-calibrated as to time, base, and gain controls. Its size makes it recommended for lecture hall demonstrations, precision measurements, and production tests.

75 SPEED REDUCERS

Westinghouse Electric Corp.—File No. 3600 describes their line of speed reducers. Types and applications are shown in illustration. Details of construction, standard ratios, and high power transmission efficiency are covered as well as engineering and maintenance service.

76 TECHNICAL BOOKS FOR ENGINEERS

Ronald Press Co.—Brochures containing detailed descriptions of current technical books on mechanics, engineering, aeronautics, industrial management, metallurgy, applied and physical sciences, etc. Practical reference works like the Ronald Handbooks, basic studies, and pioneering works on the latest engineering and scientific developments are included.

77 HYDRAULIC PUMPS, MOTORS, TRANSMISSIONS

Oliver Iron & Steel Corp., Berry Div.—Catalog No. 5209 describes the Berry hydraulic principle used in its motors, pumps, and transmissions. Diagrams illustrate its operation. Hydraulic circuits with motors, pumps, and transmissions are included, together with motor and pump ratings and engineering information.

78 DUAL DRIVE ADAPTER

F. W. Stewart Corp.—Bulletin describes "Circle Ess" Dual Drive Adapter for use in conjunction with flexible shaft drives where more than one unit is to be driven from the same power source; to provide two ratios from the same source or to facilitate attaching flexible shaft drives where limitations in space prevent direct connection without bending the shaft to the point of possible damage. Furnished with standard $^{5}/_{8}$ in. × 18 threaded connections with 0.104-in. internal square drives and in ratios or 1 to 1, 15 to 1, 16 to 1, and 17 to 1 for either left or right rotation.

Here's what micarta® LAMINATED PLASTICS is doing for aviation progress!

Aircraft manufacturers needed a pulley material that was light yet durable enough to withstand torturing cable loads at terrific speeds. MICARTA® proved to be the answer. Now over 50 million pulleys have seen service.

What can Micarta do for you?

Your particular problem may call for a material which will fight off rust, acids or corrosive atmospheres. Perhaps you need a light-tough-resilient combination of qualities. Whatever your problem is, it's highly probable that you'll be able to choose your answer from among the dozens and dozens of pay-off qualities of this amazing material.

For the complete story on this basic material just fill out the coupon below. J-06538

YOU CAN BE SURE... IF IT'S Westinghouse

Westinghouse Electric Corporation • Micarta Division, Trafford, Pa. • Attention: L. A. Padley

micarta is basic!

Sir: (Please check one)

☐ Please have your representative call

☐ Please send me the complete facts on MICARTA

Name _____ Company _____

Address _____

City _____ Zone _____ State _____

YOUR

New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

79 LOCK NUTS AND LOCK WASHERS

Standard Locknut & Lockwasher, Inc.—Bulletin No. 32 describes Standard's line of lock nuts and lock washers for ball- and roller-bearing applications, designed to SAE and ABEC applications. Dimensions of lock nuts, lock washers, and shafts are included.

80 MINIATURE BALL BEARINGS

Miniature Precision Bearings, Inc.—A 20-page, 3-color catalog, illustrated with comprehensive specifications on more than 140 types and sizes of standard miniature ball bearings from 1½ mm to ½ in. OD, includes material of particular interest to designers of precision mechanisms—applications, lubrication, design variations, special bearings, etc.

81 WELDING

American Welding & Mfg. Co.—Bulletin CA-50 discusses fabrication by controlled technique flash-butt welding. Illustrated are a variety of welded rings and bands and weldments. The bulletin discusses research engineering, fabrication technique, scientific inspection, and precision machining with many successful welding problems.

82 O-RINGS

National Motor Bearing Co.—This National O-Ring Catalog is designed for broadest usefulness in all types of O-ring applications. Includes practical working information about O-ring applications, sizes, groove dimensions, back-up rings, and dust seals, and lists all National O-Rings and local National Motor Bearing offices.

83 AUTOMATIC CONTROLS

Mercoid Corp.—Catalog Number 700B, a 64-page reference book for engineers, contains information on automatic controls for pressure, temperature, liquid level, and mechanical movement. Transformer-relays and mercury switches are also listed.

84 VALVES

Ohio Injector Co.—An easy-reference illustrated catalog gives engineering and manufacturing data on a line of bronze, iron, and cast and forged steel valves. Special tables and an index are included to facilitate selecting. The booklet also covers valve accessories and parts.

85 FILTERS

Cuno Engineering Corp.—A 6-page Bulletin No. PJL-1052 (formerly 1148-PJL) gives complete data on Cuno Auto-Klean filters—edge filtration plus positive mechanical cleaning; Cuno Flo-Klean filters—backwash filter cleaning with no loss of fluid; Cuno Micro-Klean filters—replaceable element micronic filters. Description of models for industrial filtration installations are included.

86 FASTENINGS

H. M. Harper Co.—Catalog 26 covers complete line of non-ferrous and stainless steel fastenings. An index page lists all fastenings by alloy and type for fast easy reference. Included in the booklet are complete descriptions of all Harper "Everlasting" fastenings carried in stock in brass, bronze, copper, Monel, aluminum, and stainless steel.

87 PRESSURE-TESTING INSTRUMENTS

Crosby-Ashton Co.—Catalog 500-E illustrates and describes Ashton Dead-Weight Testers for testing to pressures of 10,000 psi, Crosby Fluid-Pressure Scales for testing to 25,000 psi, and Ashton Portable Gage Test Pumps and Inspector's Test Set for testing to 600 psi. Style 179 Dead-Weight Tester and Style CD-1 Fluid-Pressure Scale are portable instruments and are furnished in convenient carrying cases. The accuracy of these instruments ranges from 0.25 per cent to 0.1 per cent.

88 HIGH STRENGTH, LOW ALLOY STEEL

United States Steel Corp.—Publication ADVL-018-53 describes in detail Cor-Ten, a tonnage grade high-strength low-alloy steel. Characteristics, economy, varied applications, corrosion resistance. Tables of mechanical properties, comparative properties and engineering data are included. Welding qualities, weight pointed out. Illustrations and descriptions of varied application to products.

89 FLOW METERS

Foxboro Co.—Bulletin 460 describes basic flow meter advances and introduces six meter types for sustained accuracy in fluid flow measurement. Bulletin 465 on "Circular Case Automatic Controllers" and Bulletin 461 on "Automatic Controllers" cover other recent developments in Foxboro's line of pneumatic, electric, and electronic instruments for indicating, recording, and controlling industrial process variables.

90 IRON CEMENTS

Smooth-On Mfg. Co.—Newly edited, 48-page illustrated handbook describes how to stop leaks through metal and concrete surfaces, tighten loose parts, anchor screws and bolts with Smooth-On iron cements. Includes sections on drying up wet cellars, hardening the surface of new concrete floors, many emergency repairs to machinery, heating units, and pipe lines.

91 VIBRATION FATIGUE TEST MACHINES

All American Tool & Mfg. Co.—16-page Catalog F54 describes the ten models of vibration fatigue test machines. Models for handling parts or assemblies from 10 lb to 100 lb in weight. Both horizontal and vertical table motion types. Manual or automatic frequency cycling.

92 TEST BOILERS

Besler Corp.—Test boiler bulletin, illustrated with photographs, drawings, and diagrams describes Besler high-temperature, high-pressure boilers. Designed by test engineers, these boilers are sectional, an innovation offering maximum flexibility, utmost weight and space conservation, and high efficiency. Bulletin contains specifications on 14 models with a range of capacities said to be heretofore impossible to attain.

93 BITUMASTIC PROTECTIVE COATINGS

Koppers Co.—Informative package of six bulletins covers (1) Bitumastic Hi Heat gray for high-temperature corrosion prevention; (2) Bitumastic Black Solution for general, low-cost maintenance; (3) Bitumastic Super-Service Black heavy-duty coating for more severe conditions; (4) Bitumastic No. 50, extra heavy-duty coating for extremely severe corrosive conditions; (5) Bitumastic No. 28, heavy-duty coating for atmospheric corrosion control; (6) Bitumastic Tank Solution, quick drying, useful for water tanks, etc.

94 INDUSTRIAL INSULATION

Armstrong Cork Co.—A 32-page illustrated booklet includes specifications for industrial low-temperature and heat insulation. It explains and illustrates insulation products and sundries, and the application of insulation materials −300 F to 2800 F. Design data, standards, and methods of construction are described.

Small Capacity • Medium Duty
SIDE SUCTION PUMPS

Close-Coupled • **Flexible Coupling** • **Belt Drive**

CAPS 5 to 75 G.P.M. — HEADS 0 to 100 ft.

Ideal as part of Equipment Manufacturer's product, such as, air conditioning units, cooling towers, evaporator coolers, milk coolers, hot water circulators, etc.—and general service. Speeds 1750 to 3500 R.P.M.

Type JMC Aurora Close-Coupled Pump

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS

AURORA PUMP COMPANY

DIVISION OF THE NEW YORK AIR BRAKE COMPANY

96 LOUCKS STREET, AURORA, ILLINOIS

GIVE ENOUGH

SOON ENOUGH

YOUR

New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

95 MECHANICAL SPRINGS

Associated Spring Corp.—"The Mainspring," the house organ of its ten divisions, is offered. It contains articles of scientific and practical interest prepared for engineers, designers, and users of mechanical springs. Published bimonthly.

96 ELECTRIC MOTORS AND GENERATORS

Star-Kimble Electric Co.—Bulletins B201, B202, B301, B302, B501A, B1001 and B1301 cover polyphase squirrel-cage motors, squirrel-cage induction motors, wound-rotor induction motors, single-phase repulsion motors, a-c and d-c brake motors, d-c motors and generators, and motor-generator sets, respectively. Brief descriptions and specifications are included for each.

97 AIRCRAFT HYDRAULIC AND PNEUMATIC EQUIPMENT

General Metals Corp., Adel Div.—Bulletin 160-86 is an illustrated brochure describing Adel's line of aircraft accessories, together with the organization's manufacturing and environmental testing facilities.

98 STEAM TRAP PROBLEMS

V. D. Anderson Co.—Bulletin No. 151 entitled "Solving Steam Trap Problems," contains 36 pages of illustrations, drawings, and charts, describing the importance of trap selection and showing application for various industries.

99 FIRE EXTINGUISHING

Grinnell Co.—More effective control of fire, with less water, for a wide variety of hazards is described in "Grinnell Automatic ProtectoSpray," which explains a new coordinated three-way attack upon fire. It has special value for fire hazards involving high-piled storage, rubber, flammable liquids, paints, and flash-fire materials.

100 FLEXIBLE, SWIVEL, SWING, AND REVOLVING JOINTS

Barco Mfg. Co.—A group of catalogs cover flexible, swivel, swing, and revolving joints for piping and lines conveying steam, oil, air, gasoline, water, chemicals, including corrosive acids and alkalies, and other fluids or gases. Types cover pressures up to 750 psi, steam, and 7500 psi hydraulic. Complete range of sizes. Catalogs No. 215 "Flexible Ball Joints;" No. 265 "Rotary Swivel Joints;" No. 400 "Barco Swing Joints;" No. 300 "Revolving Joints."

101 PILLOW BLOCKS

Fafnir Bearing Co.—The 4-page illustrated folder describes a new low-cost, light-duty ball-bearing pillow block with separable two-piece pressed steel housing. Exploded views, suggested applications, available sizes, dimensions, and load ratings are shown.

102 FLOW SIGNAL TRANSMITTER

Hagan Corp.—The Hagan flow signal transmitter is described in a new bulletin, No. 2553. This pneumatically operated pressure-differential measuring unit transmits proportional signals to remote recording or indicating instruments, or to automatic control elements. The signals may be linear with flow or linear with pressure differential. Diagrams in the bulletin illustrate seven suggested uses of the transmitter in measurement of flow, liquid fuel, liquid level, and absolute pressure. Flow applications include measurement of steam output from a boiler, superheater or evaporator; of feedwater flow to a boiler; of liquid flow through pump units; and of gas, vapor, or liquid flow in process systems.

103 MAGNESIUM CASTINGS

American Radiator & Standard Sanitary Corp.—Bulletin describes magnesium sand molded castings and points out advantages and adaptation where weight, good strength, rigidity, shock resistance and excellent machinability are required. Parts can be cast to any design and shape, and a number of design elements can often be combined in a single casting. Also resistant to vibrational stresses.

104 OIL-HEATER LEAK DETECTION SYSTEM

Davis Engineering Corp.—Bulletin 80 describes the "Paraprobe" oil-leak detection system for steam type fuel oil heaters. Consists of condensate inspection tank, designed to cause physical separation of any fuel oil that might have leaked into steam condensate. Oil is trapped, and cannot leave the tank. Exploratory probe relay contact point set in side of inspection tank at liquid line becomes coated with segregated oil, and electric alarm circuit thru the relay is made, giving warning.

105 GAS TURBINE ELECTRIC POWER PLANTS

Westinghouse Electric Corp.—Catalog B-5859 contains complete information on design features, operation, engineering and performance data, dimensions, weight, selection factors and applications on the following units: 1800 hp; 5000 hp; 5300 hp; 7000 hp of combustion gas turbine power plants for mechanical drive applications. For engineers in the gas transmission, chemical, refinery, process and steel mill industries.

106 ELECTRONIC EQUIPMENT

Hewlett-Packard Co.—Catalog describes the line of -hp- electronic test equipment. It supplies photographs, description, specifications, and application data for oscillators, vacuum-tube voltmeters, signal generators, distortion-measuring equipment, frequency-measuring equipment, coaxial test equipment, waveguide test equipment, power supplies, amplifiers, and pulse generators. A brief outline of the equipment is given on the front cover and fly-page, and the catalog is indexed both as to subject matter and model number on the rear pages.

107 REMOTE VALVE-CONTROL

Stow Mfg. Co.—Flexible shafting for the remote control of valves is the subject of a 16-page design manual. Inaccessible valves up to and including valves with 27 in. diameter handwheel may be controlled with flexible shafting, according to the manufacturer. Also, many valves in a plant may be controlled from one central station. A chart is given for the selection of the correct size flexible shaft for any valve. Different types of end connections are shown in detail.

108 PUMPS

Detroit Harvester Co., Pioneer Pump Div.—Bulletin 160-26 describes the complete line of Pioneer and Rollway pumps. Centrifugal pumps, including self-priming auxiliaries and separate tank units are illustrated with line drawings and photographs. Rollway positive displacement pumps for handling lubricating oils and other liquids with lubricating properties are shown.

109 PLANT LAYOUT TEMPLETS

Repro Templets, Inc.—Booklet explains method of plant layout, a simple, quick, inexpensive method of laying out machine tool and equipment floor plans in two dimensions. Explains layout card, templets. Bulk of booklet devoted to machine tool firms and templet requirement for various types of equipment. Also shows firms requiring templets for auxiliary production equipment, also incidental shop equipment, office equipment, building details. Price list included.

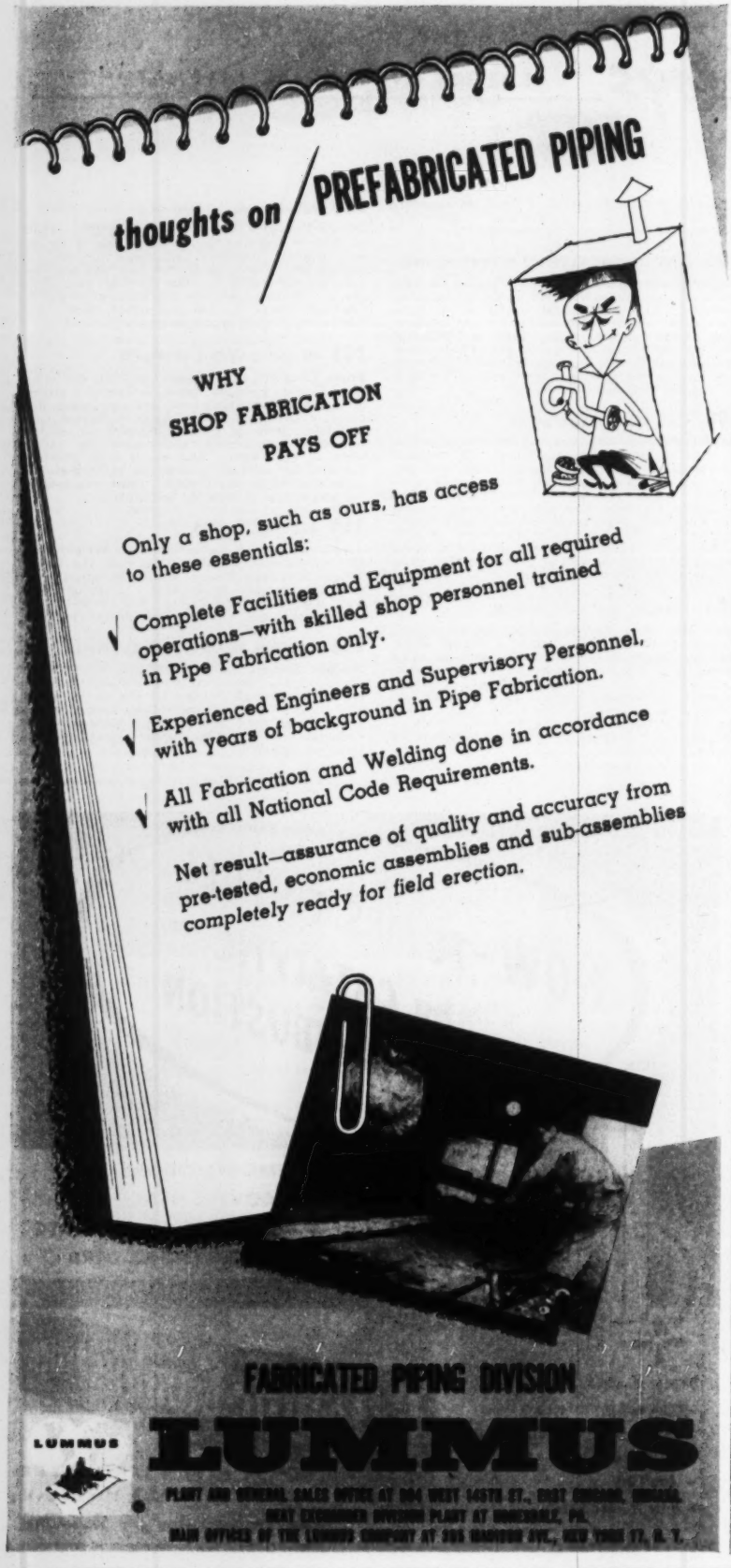
110 ELECTRIC HOISTS

American Chain & Cable Co., Inc., Wright Hoist Div.—A 68-page Catalog E-54, lists the line of Wright Speedway Electric Hoists, in capacities up to 10 tons and lifts up to 152 ft. Complete clearance data and specifications are presented, including list prices. Ordering procedure is also given.

111 ELECTRIC BRAKES AND CLUTCHES

Warner Electric Brake & Clutch Co.—Catalog #6158 contains information on a complete line of electric brakes and clutches for low torque drives. The catalog contains description, torque values, and general data pertaining to available sizes. Complete capacity tables, dimensions, and specifications are included.

NOW-FUMES TO FUEL by CATALYTIC COMBUSTION
CATALYTIC
ELEMENT
• REMOVES ODORS
• RECOVERS HEAT
• ELIMINATES CONDENSATE
• REDUCES FIRE HAZARD
Patents Pending
Dispose of mercaptans, aldehydes, organic and hydro-carbon vapors the new Catalytic Combustion way.
Safe — Dependable — Complete — Low Cost.
• Write for details today.
Catalytic Combustion CORPORATION
4548 GRAND RIVER
DETROIT 8, MICHIGAN
Fume Incineration for Industry


thoughts on PREFABRICATED PIPING
WHY
SHOP FABRICATION
PAYS OFF
Only a shop, such as ours, has access to these essentials:
√ Complete Facilities and Equipment for all required operations—with skilled shop personnel trained in Pipe Fabrication only.
√ Experienced Engineers and Supervisory Personnel, with years of background in Pipe Fabrication.
√ All Fabrication and Welding done in accordance with all National Code Requirements.
Net result—assurance of quality and accuracy from pre-tested, economic assemblies and sub-assemblies completely ready for field erection.
FABRICATED PIPING DIVISION
LUMMUS
LUMMUS

YOUR *New Catalogs* GUIDE

112 DRAWING-INK FOUNTAIN PEN

John Henschel & Co.—A booklet describes the Pelican Graphos, a drawing-ink fountain pen with 58 interchangeable nibs. The pen will draw a uniform line from hairline thickness to 1/4 in. and is ideal for technical drawing, sketching, stenciling, and lettering. Filling time is reduced because of the ink fountain advantage.

113 CAST STEEL GEARS

Farrell-Cheek Steel Co.—Folder describes cast tooth and pinion gears, sheaves, wheels, gear blanks and varied line of steel castings. Notes "85" special analysis steels for gears and "Hard Edge" for wear resistance and long life for gears and pinions.

114 CONTROL VALVES

Hydropress, Inc.—Bulletin L-43, issued by Loewy-Hydropress, with illustrations descriptive of water-hydraulic high-pressure controls, deals with hydraulic control valves, pre-filling valves, stop valves, check valves, by-pass valves, shut-off valves for hydraulic accumulators, and combination valves for sequence operation.

115 STEAM AND LIQUID CONTROL EQUIPMENT

O. C. Keckley Co.—Catalog No. 54 contains 60 pages of illustrations and engineering data on precision pressure regulators, temperature regulators, float valves, diaphragm valves, solenoid valves, water gages, float boxes, safety and relief valves, strainers, etc. Drawings, layout diagrams, dimensions, and capacity tables are included.

116 ELECTRIC AND PNEUMATIC HOISTS

Detroit Hoist & Machine Co.—Bulletins and descriptive leaflets of their line of hoists, cranes and hoisting appliances. Electric and pneumatic hoists from 1/4 to 10-ton capacity, travelling cranes up to 10 or 15-ton capacity. Also design special hoisting equipment and appliances.

117 BEARINGS

Gwilliam Co.—Tables of dimensions covering standard and special sizes of ball, roller and journal bearings, with data on replacements described in illustrated Bulletin No. S-54.

118 CONTROL VALVES

C. B. Hunt & Son.—Bulletin No. 531 is a 12-page, illustrated compilation of information about Quick-As-Wink Control Valves, for engineers and purchasing agents. It covers the most widely used valves in the line including sliding-sleeve air valves, single-plunger valves, O and OE valves, and hydraulic valves.

119 OIL AND GAS BURNERS

Ray Oil Burner Co.—An illustrated 16-page catalog gives specifications and capacities of commercial and industrial oil and combination gas-oil burners. It covers fully automatic, semi-automatic, and manually controlled horizontal rotary oil burners, gas burners, and combination gas-oil burners; commercial and domestic pressure-atomizing types for oil, gas, or combination gas-oil. Tables and other technical data are included to aid in selection.

120 HOLLOW TOOL STEEL

Crucible Steel Co. of America—Folder describes hollow tool steel in AIRDI 150, air hardened, carbon high chromium, KETOS, oil hardened, non-deforming, SANDERSON, water hardened, special quality. Typical applications listed with weight tables, and tables of sizes to finish. Practical steel tool selector with full use instructions for proper selection of tool steel required is also offered.

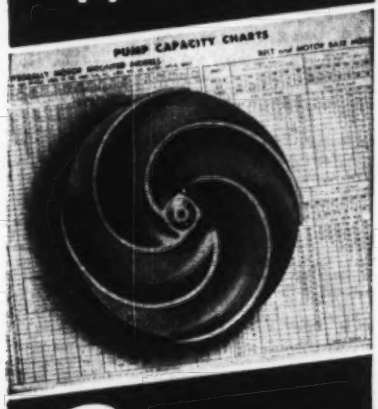
121 TURBINE-TYPE AND CENTRIFUGAL PUMPS

Aurora Pump Co.—8-page catalog and selection guide illustrates and describes turbine-type and centrifugal pumps in various combinations of capacities, heads and designs, including deep well turbines and condensate return units. Features, construction specifications, applications and condensed selection information are given for each pump unit.

122 BULK STORAGE TANKS

Graver Tank & Mfg. Co.—New 16-page booklet describes manifold uses of standard bulk tanks in storing petroleum products, chemicals, water, solvents, etc., ranging in capacity from 550 to 30,000 gallons, designed for installation vertically, horizontally or underground. Lists all standard sizes and capacities and provides useful gage tables.

Standard Pumps for Custom Applications



Pioneer PUMPS

IMPELLER TYPES

from 0 to 174 gpm
850 to 3450 rpm

Types available:

Seal and Seal-less

Integral Motor Mounted

Belt and Motor Base

External or Submerged

JIC Standard

Self-Priming Auxiliary Units

Ask for Complete Catalog of Pumps and Accessories

DETROIT HARVESTER Company

PIONEER PUMP Division

14300 Tireman · Detroit 28, Mich

(FACTORY — Paris, Kentucky)

YOUR *New Catalogs* GUIDE

123 REPORTS ON MATERIALS HANDLING

Hyster Co.—Actual case studies from the field are now available. Called "Field Reports," studies cover instructive materials handling operations in many industries. Profusely illustrated with action photographs and written in a concise and factual manner.

124 VANEAXIAL FANS

Joy Mfg. Co.—Bulletin J-611 describes the Axivane Series 1000 fans and explains the advantages of vaneaxial design and the versatility of adjustable blades. Series 1000 has 136 models, 18 to 84 in. in diameter, and producing volumes up to 150,000 cmf at total pressures as high as 11.0 in. wg. Fans are available in 19 housing diameters, four hub sizes, and five motor speeds. Specification tables are included.

125 TANKS

W. E. Caldwell Co.—Storage and processing tanks Catalog #61 covering steel and wood tanks for every type of service—including capacities, illustrations, price data and technical information on elevated tanks for industrial use, fire protection and water systems—other standard and special designs for the various industrial uses.

126 DIFFERENTIAL COMPUTER

Sperry Corp., Ford Instrument Co. Div.—Single spider-gear differentials used in military and commercial computers described in 4-page pamphlet. Engineering characteristics and performance, overall dimensions and descriptions of 1/8 in., 1/4 in., 3/16 in. and 5/16 in. differentials shown in graphical and tabular form.

127 METAL TAGS

Jas. H. Matthews & Co.—A 4-page leaflet on Matthews metal tags for shipping, inventory, production control, and coding suggests specific tag applications for various industries. Hand-operated and press style tag embossing machines are also illustrated.

128 VENTILATING FILTERS

Dollinger Corp.—12-page bulletin describes Staynew automatic ventilating filters for large air volume and high efficiency. Bulletin 500 contains specifications, engineering and performance data in a wide range of sizes for handling any desired air volume. Two methods of automatic curtain cleaning are described and information for selection and installation is included.

129 O-RINGS AND BACK-UP RINGS

United States Gasket Co.—An 8-page Bulletin No. OB-1152, describes the line of Chemiseal Synthetic-Rubber O-Rings and Chem-o-green (Teflon) Back-Up Rings for military and commercial hydraulic requirements. Complete information on application is given and product data is tabulated under both commercial and AN dash numbers for references.

130 WATER CONDITIONING

Elgin-Refinite, Div. Elgin Softener Corp.—Bulletin 611A covers water conditioning under headings of Zeolite softeners, Ultra deionizers, boiler water, process, filters and purifiers, degasitors, chemicals, water conditioning modernization and Zeolites of all types. Bulletin 512 describes Ultra deionizer for producing completely mineral free water at low cost.

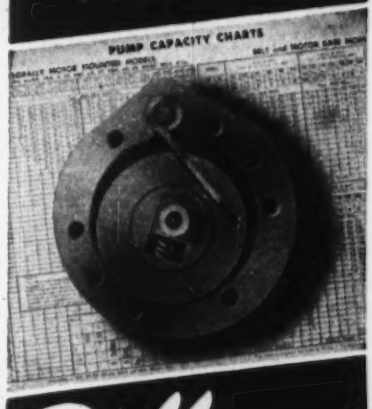
131 SCREW PUMPS

Warren Steam Pump Co.—Twelve-page, two-color Bulletin S205 is devoted to Standard Gear-in-Head, High-Pressure Long-Body Gear-in-Head, and standard Vertical Gear-in-Head types of Warren-Quimby Screw Pumps. Basic construction and design are discussed in detail and there are sectional views with indicated features; also external and installation illustrations, dimensions, and specifications. Bulletin S206 includes comparable information as applied to Double External Bearing and Hopper types of Warren-Quimby Screw Pumps.

132 IMPACT ALUMINUM EXTRUSIONS

Aluminum Co. of America—Alcoa Impact Fact Book describes the one-piece, seamless, semi-hollow or solid parts having forged bases and one or more extruded side walls. Process is fully explained and design variations and shapes are shown. Tolerances, alloy selection, chemical composition and mechanical properties of wrought aluminum alloys are shown in charts.

Standard Pumps for Custom Applications



Rollway PUMPS

POSITIVE DISPLACEMENT TYPES

from 1/8 to 60 gpm
200 to 500 rpm

Types available:

Reversing

Non-Reversing

Built with or without Automatic Relief Valve

Single or Double Eccentric

V-Belt or Direct Connected

Ask for Complete Catalog of Pumps and Accessories

DETROIT HARVESTER Company

PIONEER PUMP Division

14300 Tireman · Detroit 28, Mich

(FACTORY — Paris, Kentucky)

Here's how to

reduce size & weight

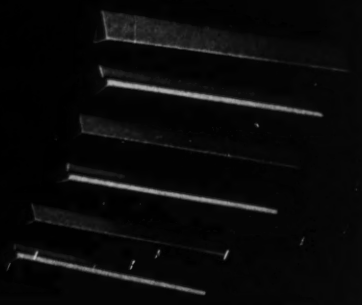
(WITHOUT DECREASING OUTPUT)

-install **MYCALEX** glass-bonded mica Slot Wedges and Brush Holders

- WITHSTAND CONTINUOUS OPERATING TEMPERATURES TO 650°F
- EXPANSION MATCHES MATING METALS—NO LOOSENING FROM COLD START TO MAX. OPERATING TEMPERATURE
- IMPERVIOUS TO OIL AND MOISTURE, NO COLD FLOW, NO SHRINKING, NO CHANGE WITH AGE
- EXTREME ARC RESISTANCE, CAN NOT CARBONIZE, WILL NOT BURN, HIGH DIELECTRIC STRENGTH

MYCALEX 410 glass bonded mica withstands continuous operating temperatures of 650°F. This temperature capability means that electrical equipment using MYCALEX components can be designed for higher ratings without change in size or weight. Generally, a unit of specified size can be redesigned to smaller dimensions. Significant gains have been made in this direction, particularly in aircraft systems. Dimensional accuracy of these parts, injection molded of MYCALEX 410 glass bonded mica, the unique ceramic-plastic insulation, exceeds that of any ceramic or plastic material. Their smooth surface speeds assembly, reduces costs. For complete information call or write J. H. DuBois, Vice President-Engineering, at Clifton, N. J. address below.

NOTE: MYCALEX 410 glass bonded mica described above, is an exclusive formulation of, and manufactured only by, the Mycalex Corporation of America. It meets all the requirements for Grade L-4B under Joint Army-Navy Specifications JAN-I-10.



SINCE 1919 MYCALEX THE INSULATOR

MYCALEX CORPORATION OF AMERICA

World's largest manufacturer of glass-bonded mica products

Executive Offices: 30 Rockefeller Plaza, New York 20, N. Y.

ADDRESS INQUIRIES TO:

General Offices and Plant: 126 Clifton Blvd., Clifton, N. J.

YOUR *New Catalogs* GUIDE

133 STEAM-GENERATING EQUIPMENT

Kewanee-Ross Corp.—The 32-page Kewanee General Catalog 80 gives full description and complete data on entire line of boilers, boiler-burner units, and other equipment for heating, power, or process steam. It includes diagrams of small residential types up to large industrial sizes of 304 hp, for steam or water, high or low pressure, mechanically fired.

134 VIBRATION CONTROL

MB Mfg. Co.—Bulletin 420 describes and illustrates a complete line of vibration exciters and calibrators, vibration meters, automatic cycling systems and isolators.

135 ELECTRICAL INSULATING MATERIAL

Mycalex Corp. of America—"Engineers Handbook and Catalog" describes Mycalex glass-bonded mica, insulation for all frequencies. Properties, dimensional stability at temperatures to 950°F., arc resistance, low loss, high dielectric strength, precision dimensions, zero moisture absorption. Available in injection-molded grades; sheets and rods in machinable grades. Miniature tube sockets, switches, commutators, high K capacitor material, printed circuit base material.

136 INDUSTRIAL LUBRICATION

Brooks Oil Co.—An illustrated brochure which tells the story of the company and the varied applications and solution of lubricating problems in industry. Outlines various industries served. Under trade name of Leadolene it shows application on mill tables, mill pinions, circulating oil systems, hydraulic systems, open gears, enclosed gears and bearings, flexible couplings, wire rope, worm drives, high temperature lubrication.

137 GAGES AND THERMOMETERS

Marsh Instrument Co.—Catalog No. 76-G describes in detail a wide line of industrial gages and thermometers. The catalog is fully illustrated, including cut-away photographs and enlargements of internal parts. It covers also gage accessories, specifications including line drawings and dimensional tables, and templates covering every size and pattern.

138 GRINDING MACHINES

Blanchard Machine Co.—Booklet presents typical examples of the machining and finishing of flat surfaces by grinding. Materials ground include ferrous metals, many non-ferrous metals as aluminum, magnesium, copper, brass, bronze, also glass, carbon, plastics, and minerals such as quartz, agate and sapphire. Mirror finish, wheel data included.

139 THREAD INSERTS

Heli-Coil Corp.—Design and engineering data on the complete line of Heli-Coil screw thread inserts—for the protection and repair of tapped threads in all materials—is contained in a 24-page, 2-color catalog, No. 652. Covered are drilling and tapping recommendations, installation procedures, and specifications for classes, 3, 3B, 2, and 2B thread fits.

140 PUMPS, COMPRESSORS, GAS BOOSTERS

Beach-Russ Co.—Bulletin No. 89 describes a complete line of rotary pumps to meet industry's requirements for sustained high vacuum or pressure at maximum efficiency with long service life in processing, handling and testing operations. Illustrated, with diagrams and specification data.

A world of facts at your finger tips. Use coupon on page 42 for *free* catalogs you need. (Sorry, no catalog distribution can be made by us to Students.)

YOUR

New Catalogs GUIDE

141 OFFICE COPY MACHINE

General Aniline & Film Corp., Ozalid Div.—A 4-page illustrated pamphlet features the new Ozalid Bambino, a fast, inexpensive, and compact copy machine for use on correpondence, accounting reports, purchase orders, invoices, and other administrative paper work. Pictures illustrate the operation of this machine and specifications describe its dimensions and capacities.

142 REMOTE CONTROL

American Chain & Cable Co.—Bulletin No. DH-287 entitled "The Key to Remote Control—Tru-Lay Push-Pull Flexible Controls" describes applications of various types of push-pull remote controls for installations ranging from delicate instruments to heavy earth-moving equipment. There is a question-and-answer section pertaining to construction, efficiency, backlash, deflection, temperature ranges, and weather resistance.

143 NYLON-LINED BEARINGS

Thomson Industries, Inc.—New bulletin describes the Nylined design principle. Bearings consist of thin drawn steel outer sleeve and free floating nylon liner. Now available in ten sizes from $\frac{1}{4}$ in. to $1\frac{1}{4}$ in. ID, the bearings are intended to provice low-cost solution to common bearing problems. Advantages claimed are that these bearings resist poundout; permit dry operation; are abrasion-resistant, corrosion-resistant, and quiet; dampen vibration; operate in liquids; are close-fit, non-contaminating, low-friction, compact, and lightest in weight; and have a replaceable bearing surface.

144 PISTON RINGS

Koppers Co., Inc., Piston Ring Dept.—A 16-page folder describes Koppers "American Hammered" piston rings for industrial use. Individual ring types shown with specifications for use in combustion engines, hydraulic systems, compressors, etc.

145 INCINERATOR STOKER

Flynn & Emrich Co.—Bulletin 1701 describes incinerator stoker with hydraulic power drive for disposal of garbage and trash. The stoker is described in detail and well illustrated pointing up economy.

146 LETTERING MACHINE

Ralph C. Coxhead Corp.—Bulletin tells how Vari-Typer lettering machine offers fast method of lettering bills of material, notes, specifications on tracings and drawings, and countless other drafting room lettering details. A few of the many styles of instantly changeable type are illustrated.

147 SPECIAL ALLOY STEEL

Jones & Laughlin Steel Corp.—"Jalloy" a special steel alloy, known as the mining steel, is described in a catalog. Shows uses, case histories, applications, comparison tables, technical information and hardness conversion tables.

148 STEAM ACCUMULATOR

Foster Wheeler Corp.—An illustrated 8-page bulletin explains the advantages, principles, and applications of the steam accumulator. In addition to instructions on how to calculate required capacity, the booklet includes a full discussion of the practical application of accumulator theory.

149 PUMPS

Aldrich Pump Co.—Catalog on reciprocating pumps, 10 to 2400 hp, includes data on direct flow pumps, 3, 5, 6-in-strokes series, 10 to 900 hp (3, 5, 7, and 9-plunger units); on Aldrich-Groff controllable capacity "Powr-Savr" pumps (5 to 125 hp); and on inverted vertical pumps, up to 2400 hp, 7 in. through $8\frac{1}{2}$-in-stroke sizes.

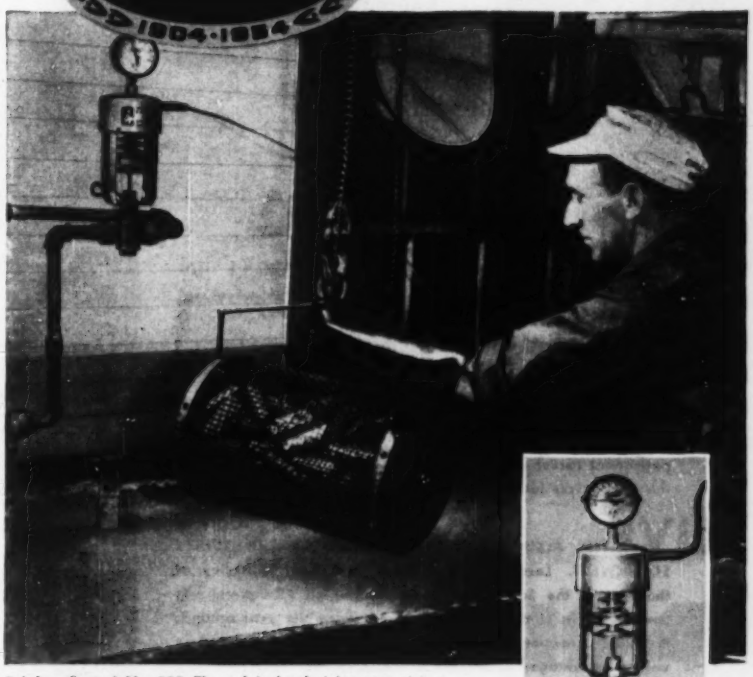
150 DRAFTING ROOM EQUIPMENT

Hamilton Mfg. Co.—Catalog No. 14, published in 1954, lists steel and wood drawing tables and files for every drafting room need. It includes comprehensive data on the Auto-Shift drafting table, and information about the shallow-drawer unit with tracing lifter.

151 SHAFT SEALS

Syntron Co.—Folder describes fully mechanical shaft seals designed to eliminate leakage of gases and liquids around rotating shafts of compressors, pumps, turbines, engines, machines, propeller shafts, mixers, etc. Also covers fluid couplings for rotating, hollow shafts.

FULTON SYLPHON 50th ANNIVERSARY 1904-1954



Sylphon Control No. 999-T, used in bonderizing operation at Modern Tool and Die Co., Cleveland, Ohio.

Saves a man's time... and his skin

SYLPHON TEMPERATURE REGULATOR NO. 999-T — *Powerful, compact, accurate. Can be supplied with or without dial indicating thermometer. Ideal for many temperature control uses.*

TANKS OF HOT ACID solutions or hot water are real problems where temperature must be controlled manually. Use of hand thermometers is risky, often causes serious injury.

Guess-work methods are avoided completely with Sylphon automatic temperature controls. The coating operation shown above is typical. Installed in the steam line, the Sylphon Control automatically assures *constant* temperature of the coating solution. Time-wasting, risky checking is out.

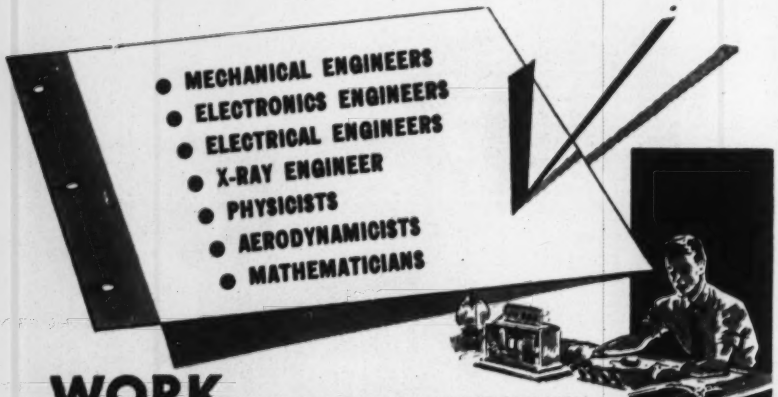
You can have this same, safe, dependable temperature control in your operations or processes, with a Sylphon Regulator. These rugged controls are self-powered and self-contained. They're designed and built to serve you for years, practically maintenance-free.

Let us help you select a Sylphon Control that will improve your operations—with savings. Write today. Tell us your requirements. We'll gladly give you full, helpful information.

SEND FOR FREE BULLETIN—Get full details of how Sylphon Temperature Regulators improve industrial processes. Send today for free Catalog GK-D.

Robertshaw-Fulton CONTROLS COMPANY

FULTON SYLPHON DIVISION • KNOXVILLE 1, TENN.



WORK ON THE FRONT LINE OF THE NATION'S VITAL DEFENSE PROGRAM. Sandia Corporation is engaged in the development and production of atomic weapons—a challenging new field that offers opportunities in research and development to men with Bachelor's or advanced degrees, with or without applicable experience. Here you can work with able colleagues, eminent consultants and superior facilities on advanced projects of high importance — and also build a permanent career in a rapidly expanding field with a company that recognizes individual ability and initiative.

LIVE IN ALBUQUERQUE, THE HEART OF THE SUNNY SOUTHWEST. Located in the historic Rio Grande Valley at the foot of the Sandia Mountains, mile-high Albuquerque is famous for its climate—mild, dry and sunny the year around. A modern, cosmopolitan city of 150,000, Albuquerque offers unique advantages as a place in which to live. Albuquerque's schools, churches, theaters, parks, and modern shopping facilities afford advantages of metropolitan life—yet hunting, fishing, skiing and a multitude of scenic and historic attractions may all be found within a few hours' drive of the city. New residents have little difficulty in obtaining adequate housing.

ENJOY THESE OTHER IMPORTANT ADVANTAGES. These are permanent positions with Sandia Corporation, a subsidiary of the Western Electric Company, which operates Sandia Laboratory under contract with the Atomic Energy Commission. Working conditions are excellent, and salaries are commensurate with qualifications. Liberal employee benefits include paid vacations, sickness benefits, group life insurance, and a contributory retirement plan. This is not a Civil Service appointment.

Make Application to:

PROFESSIONAL EMPLOYMENT
DIVISION B

SANDIA *Corporation*

SANDIA BASE • ALBUQUERQUE, NEW MEXICO

New Catalogs

152 ROLLER CHAIN

Atlas Chain & Mfg. Co.—32-page illustrated catalog with engineering and buying data on roller chain. Roller chain construction and features, selection and design, computing chain length, length conversion tables, chain drive layout, hp ratings, installation and maintenance, lubrication, list prices and specifications, special chains and attachments.

153 O-RINGS

Linear Inc.—Compact 6-page folder contains tables of standard O-ring sizes as well as dimensional data, for installation. Notes contain general recommendations on clearances, design, material, machining, and finishes for most O-ring applications. A special compound bulletin describing the latest polymers and synthetic rubbers from which O-rings can be moulded is also included.

154 TAPPING SCREWS

Townsend Co.—Bulletin TL-88, 8 pages, recently released, describes in detail 7 types of tapping screws for economical, quick, secure fastening of sheet metal, castings, forgings, plastics, plywood and composition materials.

155 SPEED REDUCERS

D. O. James Gear Mfg. Co.—Herringbone-gear speed-reducers are cataloged in 60-page illustrated Catalog No. 40-D. Parallel-shaft, offset-drive, single, double, and triple reduction speed-reducers, with ratios from 2.1 to 370.1 and ratings from 0.5 hp to 5000 hp, and straight-line drive, double reduction speed-reducers, with ratios from 11.1 to 76.5:1 and ragings from 0.8 hp to 800 hp, are listed. Specifications and recommended practice for selection are included.

156 STAINLESS STEEL FABRICATION

U.S. Steel Subsidiaries.—136-page handbook describes stainless steels produced by U.S. Steel, lists all properties, and provides complete details on end use and fabricating practices. Includes data on welding, riveting, soldering, joint design,, machining, cutting, forming, annealing, pickling, and surface finishing and protection.

157 CRYOGENICS AND MECHANICAL CONSULTING

Arthur D. Little, Inc.—Catalog describes services and equipment for the production, handling, and storage of low-boiling liquefied gases, a high field-strength electromagnet, and other specialized equipment. The Mechanical Division of Arthur D. Little, Inc., also provides prototype-equipment development and mechanical consulting services, particularly in the areas of thermodynamics, heat transfer, refrigeration to −456 F, vacuum engineering, gas liquefaction, electromagnetism, mechanical design, vibration, and noise reduction.

158 PLANT LAYOUT SYSTEM

Peerless Photo Products, Inc.—An illustrated bulletin tells how conventional plant layout procedures which entailed high cost and many man-hours of drafting are now replaced with a low cost plant layout system involving the use of photocopy. Countless prints of the master layout are said to be possible on a Peerless "Magic Hand" vacuum-bed printer without damage to the original or loss of sharp reproduction. A complete file of successive plant layout prints is always on hand, with minimum cost and labor.

159 PIPE SUSPENSION SYSTEMS

Basic Engineers, Inc.—Folder on methods of pipe suspension and fabrication of complete piping suspension systems for any requirement. Consideration of Thermal analysis at points of support, clearances, hanger loads, types of materials, weight of pipe, substance to be moved and location.

160 INDUSTRIAL RUBBER

Roth Rubber Co.—Bulletin describes parts made from natural rubber, Neoprene, Bune N, GR-S, Butyl, Thiokol and Silicone. More than 700 stocks covering temperature, oil and fuel, chemical resistant, rubbers to laminate or bond, silicone and sponge. Molded, extruded or die-cut parts. Sampler available showing various types of varied thickness and hardness.

161 BOILER SERVICE VALVES

Everlasting Valve Co.—Bulletin describes the Everlasting Quick-Opening and Slow-Opening Straightway Valves, Angle Valves, Y Valves, and Duplex Blow-Off Units, with specifications, materials of

New Catalogs GUIDE

construction, and dimensions of each type. Illustrations include details of design, sectional and exploded views, and explanations of operation of the valves. A section of the bulletin also describes Everlasting valves for fire protection.

162 ELECTRICAL HEATING UNITS

Edwin L. Wiegand Co.—Booklet illustrating and describing 101 ways to apply electric heat and showing approved methods of electrically heating liquids, air, gases, machine parts and process equipment. All items are illustrated and described in detail and varied applications are shown. The heating units go under the trade name of chromolox.

163 BELT CONVEYER IDLERS

Link-Belt Co.—More than 500 belt conveyer idlers in 34 types are pictured and described in 48-page Book No. 2416. All types of idlers for light-, medium-, and heavy-duty applications are featured—troughing, flat belt, belt training, rubber cusion, variable troughing, return—with information for proper selection and spacing, based on weight and lump size of material to be conveyed.

164 STEEL HEATING BOILERS

Fitzgibbons Boiler Co.—Catalog SW-54-B covers complete details and specifications for the full line of boilers. Sizes and types to heat the small home to the largest building using oil, gas or coal. Tanksaver (R) and Tankheated copper coils for service hot water avilable for all boilers.

165 MOTOR SPEED CONTROLS

General Radio Co.—Bulletin describes nine models of motor speed controls with ratings from 1/18 hp to 1 1/2 hp. All models use selenium rectifiers in a circuit arrangement which gives smooth control over a wide speed range. Complete specifications included with application details.

166 AXIAL BLOWERS

International Engineering, Inc.—Bulletin No. 104 describes line of axial blowers with full construction detail, performance, uses, drive arrangements, dimensions and capacities. Also covered are stack fans, exhaust and man-cooling fans, duct boosters. Illustrated with tabular and other data.

167 REFRIGERATION CONDENSERS

Henry Vogt Machine Co.—New 40 page refrigeration condensers bulletin, RC-2 with photos, line drawings, and engineering data. Covers a complete range of sizes and types for ammonia and Freon-12. Includes condenser-tower units.

168 INDUSTRIAL INSULATIONS

Johns-Manville—A 40-page catalog. Brochure IP-6A, with descriptions, uses, and sizes of the principal products in the J-M industrial line. It illustrates and describes various types of J-M industrial insulations, and also serves as a reference catalog for information on J-M asbestos-cement pipes, friction materials, electrical materials, packings, flooring, and roofing.

169 PIPE LININGS

Centriline Corp.—Booklet describes cleaning and cement lining of metal pipes in place underground in sizes from 4 to 144 in. These linings increase and maintain pipe-carrying capacity, protect pipe against corrosion, and prevent leakage where pipe has been penetrated by exterior or interior corrosion.

170 STEAM CYLINDER LUBRICATION

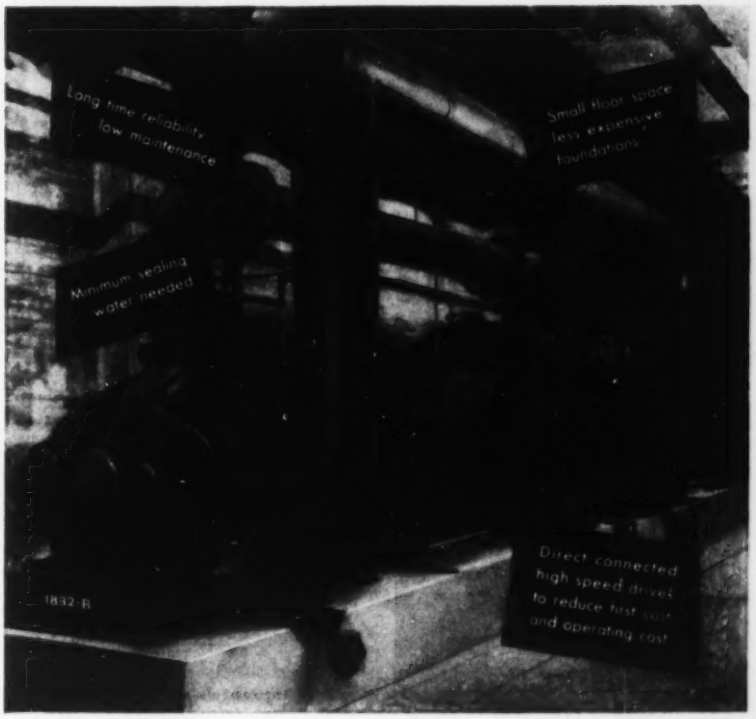
Ohio Grease Co.—Scientific lubricator Bulletin No. B1-001 describes in detail the selection, processing, compounding, analyzing, and application of lubrication made to meet the exacting specifications of steam cylinder lubricants.

171 DRUMS FOR CORROSIVE PRODUCTS

Pressed Steel Tank Co.—Catalog of complete line of tight and removable head drums and barrels designed for shipping dangerous and corrosive products. Unique crevice-free interior permits complete emptying, minimizes cleaning and eliminates the fear of product contamination. Available tailor-made to specifications of carbon steel, stainless steel, nickel, monel or other alloys.

172 STEEL CONCRETE FORMS

Irvington Form & Tank Corp.—Catalog fully illustrated shows many types of concrete construction with aid of steel forms. Used for walls, floors, columns, dams, manholes and circular tanks.


Long time reliability low maintenance
Small floor space less expensive foundations
Minimum sealing water needed
Direct connected high speed drives to reduce first cost and operating cost
1832-B

BE SURE ABOUT THE "BIG 4"

when you select Vacuum Pumps

To a large extent, these 4 basic values delivered by Roots-Connersville Vacuum Pumps account for the continuing upsurge in R-C installations. We can show you figures from users that prove the economies in first cost, and in power and water consumption, because of high speed (600 rpm or more) direct-connected drives.

Similarly, the records show remarkable freedom from maintenance, with resultant cost reduction and, more important, freedom from down time that can cause serious losses of production. These advantages accrue whether the installation consists of single or compound units—and regardless of capacity. Naturally, the larger the units, the greater the savings, both dollar-wise and percentage-wise.

We suggest that if you are considering vacuum pumps for new installations or replacements, you check with R-C engineers to see how you can reduce your costs without sacrificing any element of long-time, reliable performance. Or, ask for Bulletin 50-B-13 which gives detailed descriptions.

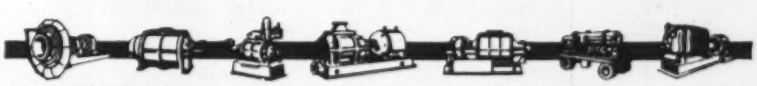
CENTENNIAL 1854 1954

Reg. U.S. Pat. Off.

BLOWER BUILDERS SINCE 1854

ROOTS-CONNERSVILLE BLOWER

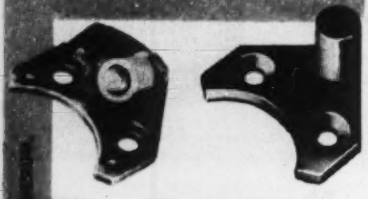
A DIVISION OF DRESSER INDUSTRIES, INC.
454 Michigan Ave. • Connersville, Indiana



Centrifugal and Rotary Positive Blowers and Exhausters • Positive Displacement Meters • Vacuum Pumps • Gas Pumps • Inert Gas Generators • Spiroxal Compressors

Costly Work Stoppage Eliminated by EPCO

INVESTMENT CASTINGS



The part at left was composed of a machined stamping, two screw machine parts and a hardened steel bushing. The constant twisting and breakage of this fabricated part resulted in almost daily stoppage of the conveying system on which it was used.

By contrast, the part on the right, cast in *one piece* without further machining by EPCO Investment Casting, actually cost less and increased production. By making this important part from an air hardening tool steel, further heat treating was unnecessary, and a hardness of Rockwell "C" 53 to 55 was attained.

PRECISION CASTINGS IN ANY CASTABLE ALLOY EXCEPT ALUMINUM

Send Us Your Drawings For Quotations On Parts Where EXTRA QUALITY Must Be Maintained.

EPCO ENGINEERED PRECISION CASTING CO.

N. J. HWY. 79
MATAWAN, N. J.

YOUR New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

Many diagrams and data on erection and stripping on many types of construction are illustrated.

173 ALUMINUM-COATED STEEL

Armco Steel Corp.—Catalog of aluminized steel covers what this special-purpose sheet steel is; its heat resistance, heat reflectivity, applications, mechanical and forming properties, and ordering range. Sections on painting and finishing, welding and brazing round out the catalog, well illustrated with photographs and drawings.

174 ADHESIVES

Minnesota Mining & Mfg. Co., Adhesives & Coatings Div.—Most important adhesives, coatings and sealers produced by 3M are listed in 8-page bulletin for quick determination of the type of product best suited to a particular manufacturing operation. Typical applications are illustrated and tabular listings quickly show technical data necessary for customer selection.

175 DRAWING PENCILS

Eagle Pencil Co.—Free sample of turquoise drawing pencil made with 100% "Electronic" graphite. With it, comes a folder describing how it will sharpen to a needle point so strong and durable it will actually play a phonograph record.

176 PRESSURIZED MANOMETERS

Meriam Instrument Co.—Bulletin No. 28 describes fully their pressurized manometer. Reduces high pressure measurement to hand valve operation. Makes for greater accuracy in calibration of gages as well as direct reading of higher pressures encountered in turbine engine development, high torque measurement and other research projects. Shows principles of operation, description, total pressure manometer, models. Schematic flow diagram included.

177 SELECTION OF TUBING

Tube Reducing Corp.—A four-page illustrated bulletin describes application advantages of different types of tubing. Comparative tensile strengths, tolerances and surface finishes available in several types of tubing for product applications are discussed. Another section describes unique compression-forming method of cold working seamless tubes. Photographs show compression-forming, tube reducing machine and the wide range of shapes, tapers and inside contours produced.

178 HOT WATER STORAGE HEATER

Patterson-Kelley Co.—48-page catalog, pictures and describes horizontal and vertical heaters in steel, copper lined, copper-silicon, cement lined, clad and galvanized construction, and low-flow design. Each cataloged as to weights, dimensions, construction details, and capacities, with conversion tables. Includes piping diagrams for high and low pressure steam systems. Also guide for setting up and connecting a storage heater. Average water requirements of typical hot water fixtures in various types of buildings with examples, how requirements may be calculated, capacity requirements determined and heaters specified.

179 ELECTRIC MOTORS

Leland Electric Co.—Illustrated color folder describes their line of electric motors ranging from 1/6 to 5 hp. Precision manufacturing process described and diagrammatic cut-a-way shows full detail of integral hp, single phase, repulsion start induction, open motor. Various applications listed.

180 GEAR REDUCERS FOR COOLING TOWER FANS

Lufkin Foundry & Machine Co.—Bulletin G-2 illustrates and describes a complete line of standard single reduction spiral bevel gear reducers especially designed for cooling tower fan drives.

Use a CLASSIFIED ADVERTISEMENT for Quick Results

181 PERMANENT MAGNETS

General Electric Co., Carboloy Dept.—Technical report PM-111 describes Carboloy permanent magnets, sintered grade 5, gives design information, tolerances, engineering service, applications, magnetic properties, physical properties. Technical report PM-112 describes cast grade with comparative information as on sintered grade 5. Illustrated with tables.

182 AUTOMATIC PRECISION TAPPING

Automatic Methods Inc.—Bulletin 101, 102, 103 show how "Auto-Tap" precision and production tapping can be done by unskilled help on standard low cost drill presses. Advantages of lead screw tapping are discussed and several methods of fixturing on typical applications are described. Bulletins include assembly drawing, a step by step description of rapid set-up, prices. Supplementary bulletins describing newer models for tapping on any drill press with larger sized taps, and recently introduced Auto-Tap tapping heads are included.

183 DRAWING INSTRUMENTS

B. K. Elliott Co.—Illustrated folder describes line of drawing instruments, drafting supplies and related items. Various assemblies of drawing instruments are covered in detail as are lettering instruments, protractors, scales and slide rules. Attention is invited to school sets. Other Bulletin covers tracing cloth.

184 THREAD MILLING CUTTER

Detroit Tap & Tool Co.—Manual D-52 contains complete technical information on the thread milling process. It covers speeds and feeds, maintenance, inspection and tolerances and milling cutter types, plus details on standard stock blanks and ordering information. Different types of thread milling cutters and their uses are illustrated. Tables list standard keyways and taper shanks.

185 SUPER REFRACTORIES

Carborundum Co., Refractories Div.—Form No. 5120 describes super refractories in well illustrated text and tables with engineering data on use and selection. Subjects cover Carborundum, Carbofax, Alfrax, Mulfrax, and Monofrax. Corrosion or abrasion, heat conductivity and chemical inertness are discussed.

186 BROACHING MACHINES

Colonial Broach Co.—Catalog contains illustrations, descriptions and specifications for each of 12 basic machine types. Descriptions include: Single and dual-ram machines for surface broaching; pull-up and pull-down machines for internal broaching; horizontal, ram-press and "utility" press machines for either surface or internal broaching and "Junior" hydraulic presses for light-duty assembly or broaching work.

187 ELECTRONIC STEAM HEATING CONTROL

Warren Webster & Co.—A 16-page illustrated bulletin describes the principles of the electronic Webster moderator system of steam heating utilizing orifices in radiators to balance distribution, with outdoor thermostat, and regulation of pressure difference to provide continuous heating and maximum comfort.

188 SILENT CHECK VALVE

Williams Gauge Co.—Pamphlet describes flanged silent check valve in sizes from 1 to 10 in. in one type and from 12 to 20 in. in another. Drilling table for 125 lb American Standard semi-steel-bronze trimmed, also drilling table for 250 lb 1/16 in. raised face. Illustrated uses.

189 GAS TURBINE POWER PLANT

Westinghouse Electric Corp.—Bulletin B-5887 describes 500 kw power plant. A clear picture-book treatment covering both gas turbine and generator. Design features, cycle arrangements and application possibilities are included. Engineering data and clear guidance to assist application engineers.

190 STEAM TRAPS

Armstrong Machine Works—44 page steam trap book explains the benefits of good trapping practices. In addition to conventional product data this catalog contains fourteen pages of trap selection helps and four pages devoted to installation and maintenance procedures.

Continued on Page 60

NICHOLSON TRAPS UP PRODUCTION

at Certain-teed Plant

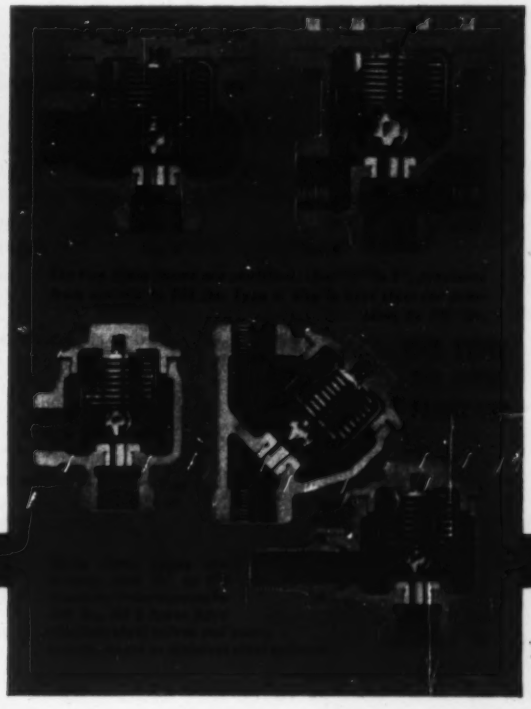
Above, Certain-teed Products Corporation's Dallas, Texas, roofing plant, where Nicholson steam traps have been adopted as standard.

Why this modern Dallas, Tex., plant of Certain-teed Products Corporation has standardized on Nicholson steam traps may be important to you. It was because, as a plant official stated, "Nicholson traps have cut loss of steam and improved operations generally". More specifically, a recent survey showed these Nicholson features to be the reasons why leading plants are increasingly standardizing on Nicholson thermostatic traps:

(1) Two to six times average drainage capacity. (2) Operate at lower temperature differential. (3) No air binding. (4) Freeze-proof. (5) Only one moving part. (6) No need to change valves for varying pressures. (7) Record low for steam waste. Types for every process, power and heat application.

Send for
CATALOG 953
Contains installation diagrams and data for determining proper size of trap.

Nicholson traps on drying drums of asphalt saturator; Certain-teed's Dallas, Tex., plant.



NICHOLSON

TRAPS · VALVES · FLOATS

219 OREGON ST., WILKES-BARRE, PA.

Sales and Engineering Offices in 58 Principal Cities

URGENT!

Be sure your company takes advantage of the FREE PRODUCT LISTINGS in the directory section of the 1955 MECHANICAL CATALOG

The editors of Mechanical Catalog are expanding and improving the directory section to make it of even greater service to you . . . of even greater value to manufacturers of products used and bought by mechanical engineers in industry.

Listing guides have been sent to 4,300 companies to enable them to conveniently check off products they wish listed in this valuable reference book. Likely your company has received one of the guides. If it has not been returned to us, you'll do your company and the Society a great favor by expediting its return. If your company has not received a free product listing guide, drop us a line and we'll forward one immediately. By all means, be sure your company's products are listed in the directory section of the 1955 MC.

MECHANICAL CATALOG

Published annually as a service for members by

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

29 West 39th Street, New York 18, N. Y.

YOUR

New Catalogs

GUIDE

LATEST INDUSTRIAL LITERATURE

191 HYDRAULIC LIFTS

Wayne Pump Co.—"Liftronics," the science of materials handling through hydraulic lifts is explained in 16-page two-color illustrated data book. Product information, sizes, engineering drawings, construction details, plus many installation photographs. Products include: tilting loading dock ramps, tilting loading dock truck lifts, cross-over bridges, straight platform lifts, industrial truck service lifts.

192 PIPING

A. M. Byers Co.—32-page technical bulletin "Piping for Permanence" presents factual information on requisites of a piping system, definitions and factors affecting service life of piping, information on analysis of water problems and summary of service records in numerous piping services. Illustrated.

193 GEAR DRIVES

Foote Bros. Gear & Mach. Corp.—Engineering Manual LPB describes straight line helical gear drives. Types, construction, features, selection, load characteristics, service factors, horse-power ratings, permissible overhung load, and dimension are shown. Formulae for calculating strength and wear and transmitting capacity of various types of gears.

194 ROLLING MILL DATA

Farrel-Birmingham Co.—36-page bulletin describes and illustrates rolling mills, gear drives, pinion stands and rolling mill handling equipment. Included in booklet are pictures of more than thirty sizes and types of mills for nonferrous rod, strip or sheet, metal foil and cold strip steel, plus illustrations of related equipment, all informatively captioned.

195 MATERIALS HANDLING

Jeffrey Mfg. Co.—Catalog #860 describes experience covering nearly three-quarters of a century, studying handling and processing problems of industry and designing and manufacturing machinery to meet them. The results of service to many types of industries are embodied in this catalog. Describes full line of conveyors, feeders, gravimetric weighers, crushers, shredders, barrel packers, coolers, dryers, magnetic separators, screens, transmission machinery, elevators, power scoops, electronic controls, bin level indicators, rotary bin check valves, car pullers, chains and sprockets.

196 STOP WATCHES AND CHRONOGRAPHS

Herman H. Sticht Co.—Bulletin describes precision timing instruments represented by stop watches and chronographs. Points out unbreakable coil spring mechanism. Illustrates and notes various types with full data, for a number of purposes. Shows recording chronographs, stop watchman and curvimeter for scaling blueprints.

197 COPPER PLATED GEARS

Brad Foote Gear Works—Bulletin presents "Certified" advantages, that is copper plating of gears, reducers, gearmotors, assemblies, and transmissions. Illustrations of large variety of products and applications. Products in any ratio and all hps.

198 AIR-OPERATED CHUCKS AND CYLINDERS

Cushman Chuck Co.—Catalog PO-64-1953 gives complete engineering data and prices on steel and aluminum body chucks and air cylinders designed to operate without chatter at high speeds to provide low-cost, time-saving tooling on repetitive operations. It also includes reference chart, installation instructions, and schematic diagrams.

199 HOSE COUPLINGS

Robb Mfg. Co.—Pamphlet describes "Quick Seal" hose couplings. Shows characteristics, tables and dimension charts of straight-through couplings with prices. Also check-valve couplings with charts and dimensions, double check valves, standard end connections, code symbols for materials, prices. Block-ell couplings, accessory connections, packers all with prices are also described.

200 INDUSTRIAL TRUCK REMOTE CONTROL

Barrett-Cravens Co.—Bulletin 534 describes advantages of radio remote control for electric industrial trucks and tractors. Illustrations show application and use. Known as "Radox" operator, by means of small control box attached to belt moves truck or trailer train, forward, around turns, and stops, without going near truck or trailer.

201 THERMOPLASTIC PIPE AND FITTINGS

United States Rubber Co.—Bulletin describes "Uscolite", a rigid, tough, lightweight, corrosion-resistant thermoplastic pipe. Chemical properties, uses, resistance given. Threading and machining, bending, dimensions, installation, valves with tables and diagrams of fittings.

202 MACHINE TOOLS

Van Norman Co.—6-page bulletin series, describes four new machines, of which the pamphlet on the Number 24-M plain and universal ram type milling machine is one. Each bulletin describes features of the machines, and pictures their various advantages from the standpoint of increased work range, ease of operation, simplicity of control, "Flex-Ability" and "Cut-Ability."

203 SPEED REDUCERS

Cleveland Worm & Gear Co.—Bulletin 130 outlines worm gear speed reducers, types AT and RT. Data on service classifications, hp ratings, efficiency curve, dimensions, coupling clearances, coupling bores and standard shaft extension diameters, construction. Well illustrated with very complete line drawings and tabular data.

204 CATHODE-RAY OSCILLOGRAPHS

Allen B. DuMont Laboratories, Inc.—Loose leaf bulletin, Form 760, describes complete line of cathode-ray oscillographs, cathode-ray tubes, and accessory equipment. Complete specifications and operating characteristics are given.

205 FEEDWATER HEATERS

Westinghouse Electric Corp.—All types of vertical and horizontal feedwater heaters are described in detail with cut-a-way illustrations in a 24-page, 2-color booklet. Accepted modern practice in feed-water heating are set forth with flow diagram of heating cycles. Features Lamiflex seal and exclusive baffle designs. Title B-5653.

206 GEAR SPEED REDUCERS

D. O. James Gear Mfg. Co.—Catalog No. 47-C describes full line of motorized speed reducers. Tables of speeds, selection data, complete tables of sizes, rpm and prices. Diagram data and tables of various types, rating tables. Fully illustrated.

207 DUST COLLECTORS

Prat-Daniel Corp.—An 8-page catalog has been published illustrating and describing the company's Design 4P collectors. Contents include a discussion of the problems of fly-ash collection and the Design 4P tubular collector. Efficiency curves, arrangements, and standard dimensions are given, flue-gas density tables are included with a formula and nomograph for calculating the number of tubes required for any volume and resistance.

208 LEVEL INDICATORS

Bin-Dicator Co.—Catalog presents data on line of pressure-actuated bin level indicators for indicating level of granular, pulverized and semi-liquid materials stored in tanks, silos, hoppers and bins. Also supplied with remote alarms. Operate through pressure of stored material against flexible diaphragm linked to counterweight. New Catalog covers installations and engineering data.

209 STEAM GENERATORS

United States Radiator Corp., Cyclotherm Div.—"All Your Questions Are Answered by Cyclotherm' tells story of patented "Cyclonic Combustion'". Explains how Cyclotherm manufactures generators with only two passes; building smaller, more efficient boilers, yet still extract maximum heat from fuel used to fire package boilers from 10 to 600 hp.

210 OIL-HARDENING STEEL

Firth Sterling Inc.—Catalog Section 20-020 describes Invaro, a "non-shrinking" type of die steel, claimed to harden deeply with a closely refined grain structure to make possible a great many high-production grinds and show almost no tendency to warpage as a result of heat treatment. The publication provides information on characteristics, annealing, drawing data, etc.

YOUR

New Catalogs

LATEST INDUSTRIAL LITERATURE

GUIDE

211 LIQUID METERS

Neptune Meter Co.—New 20-page bulletin describes meters for handling over 100 industrial liquids in processing, batch mixing, cost control operations. Includes Auto-Stop meter with automatic quantity control for accurate formulas. New meter-selector charts give complete selection and specification data for over 30 different liquid meters. Capacities from 2 to 1000 gpm, temperatures to 250 F, pressures to 500 psi.

212 DIRECT-FIRED HEATERS

Arthur A. Olson & Co.—Folder describes space heating direct-fired heaters also used for make-up air, drying, oven, process and high temperature applications. Explains operations, advantages also has tables for selection with diagrams.

213 ALUMINUM EXTRUDED SHAPES

Revere Copper & Brass, Inc.—A booklet on extruded products includes an introduction to the extrusion process and typical Revere alloys. Nomenclature and definitions are given concerning various extruded shapes together with characteristics and standard tolerances. Suggestions regarding design and many illustrations of typical applications are included.

214 INDEXING DIAL FEED TABLES

A. K. Allen Co.—Bulletin No. TTA describes briefly the various features of the three models available. Tables are for either air or hydraulic operation, and come in choice of either 4, 6, 8, 12 or 24 positions. Accuracy guaranteed to ± .002 at the periphery of an 11 in. diameter top plate.

215 WIRE FORMS

Dudek & Bock Spring Mfg. Co.—Educational brochure gives complete story on the nature and uses of wire forms. Shows how wire forms can do the job of more complicated parts. Brochure translates technical data into understandable language. Also includes valuable informative chart on coil spring manufacturing variations.

216 STEEL-WELD FABRICATION

R. C. Mahon Co.—Catalog points up advantages of Steel-Weld fabrication of massive bases, frames, mounts, and other heavy machinery parts and assemblies formerly produced in casting form. Many illustrations of use in many industries. Shows many products made by this process.

217 CONTINUOUS BLOWDOWN CONTROL VALVES

Strong, Carlisle & Hammond Co.—Bulletin CB-54 explains purpose and advantages of continuous blowdown versus intermittent blowdown. Explains problem of accurately controlling relatively small quantities of water when passing from high pressures to low pressures. Units are so designed that wide variety of orifices are available making it possible to practically custom-size each unit to the operating conditions. Built for pressures up to 1800 psi. Catalog 68-G shows these valves also steam traps, reducing valves, strainers and steam specialties.

218 BURNER EQUIPMENT

American Gas Furnace Co.—Catalog No. C6A describes in full detail their burner equipment, in tables, diagrams and illustrations. Shows blowpipes, open flame burners, blast ring burners, glass fires, cross fires, fish tail burners, torches, round blast type, mixers, oxygen-gas burner, nozzle mixing burners, compressors, filters.

219 NEW METHOD OF LUBRICATION

Stewart-Warner Corp., Alemite Div.—Catalog describes new method of lubricating industrial machinery with "Oil-Mist." Bulk of publication taken up with engineering data, covering applications, operation, bearing application, bearing speeds for this method. Also for plain bearings, selection of condensing fittings, intermixing of condensers, bearing grooving and many other engineering data appropriate to the subject.

220 REDUCTION GEARS FOR TURBINES

Elliott Co.—Bulletin H-19 describes high-speed reduction gears for mechanical drive turbines, built-in or flexibly coupled units. Contains design and material specifications, cut-a-way of built-in type, design features of reduction gears and data on built-in and coupled units.

221 PULVERIZING EQUIPMENT WITH CEMENTED CARBIDE

General Electric Co., Carboloy Dept.—Bulletin WR-107 discusses the improvement of pulverizing equipment with cemented carbide. Shows how it operates more efficiently in grinding faster, better and at lower cost. Tabulates materials which can be ground. Increases wear and hammer life. Shows carbides for heavy duty applications.

222 STEEL FABRICATION

Quaid Fabrications, Inc.—Bulletin No. 10 describes various fabrication in stainless steel and alloys, also magnesium, titanium, aluminum and dural. Service includes small assemblies, precision housings for electronic equipment and other precision equipment. Also refers to heat exchanger division.

223 DUST AND FUME COLLECTORS

Northern Blower Co.—Catalog 1002-6 describes exhaust fans for dust collecting and air handling and includes complete performance tables, test curves, etc. Plans and elevations of typical dust-collecting installations are shown. Separate additional bulletins contain descriptions, dimensions, capacities, etc. of Norblo bag type, hydraulic type, and centrifugal dust collectors.

224 LEAK-PROOF VERTICAL SHAFT PUMP

Nagle Pumps, Inc.—Bulletin TV, describes the new "TV" pump, a centrifugal, vertical shaft, dry pit pump, for chemical plants, power plants, coal mines, metal mines, etc., where freedom from leakage is vital. 1 in. to 10 in. sizes. Capacities to 2000 gpm. Can be mounted on wall or side of sump or tank.

225 HARD-FACING ALLOY METALS

Coast Metals, Inc.—Catalog on Hard-Facing indicates advantages and applications of metal alloys and gives in table form physical properties and typical uses. Illustrated examples are shown of performance of metals on hot clinker crusher rolls, hot shear knives, drag line buckets, muller tires, shredder knives and edging rolls.

226 ELECTRIC HOISTS

Electro Lift, Inc.—Bulletin No. 36 describes line of electric worm-drive hoists. Features, advantages, construction and applications noted. Also hoist with plain trolley for monorail track given in standard ratings and dimensions. Motor driven trolley monorail hoists, twin-hook monorail hoists, also with ratings and dimensions. Illustrated.

227 WOODRUFF KEYS

Standard Horse Nail Corp.—Pamphlet describes woodruff keys, made from cold drawn stock ASA. Illustration in line cuts of sizes. Also mention line of machine keys, taper pins, straight pins, cotter pins and special parts.

228 SHEET METAL STRUCTURES

Lindsay Structure, Inc.—Catalog describes method of using "Pre-Tensed" sheet metal for buildings, rooms, partitions, truck bodies, housings for equipment. Explains principles, assembly method, applications. Diagrams and structure data, tables of weights. Drawings of component parts. Fully illustrated.

229 BRONZE BEARINGS

Chrysler Corp., Amplex Div.—Bulletin S-53 describes and illustrates 700 Oilite Bronze Bearings and Oilite Cores, Bars, and Plates stocked "for immediate delivery" by Oilite dealers and depots throughout United States and Canada. In addition to manufacturing and technical data, the catalog gives instructions for machining Oilite bronze, finishing the bore, handling of bearings, and other tabular processing information.

230 TEMPERATURE CONTROL

Fenwal, Inc.—Catalog No. 400 gives information on the entire Fenwal temperature control and detection line except for new products manufactured within the past year. The catalog pictures the units in specific applications and gives performance specifications. Modifications and special features to the standard line are also discussed. Other products include Miniature Thermoswitch Controls, Midget Thermoswitch Controls, and Detect-A-Flo Control.

Eliminate
Costly and Dangerous
WATER
HAMMER
in your piping system
with

WILLIAMS-HAGER
FLANGED
Silent
CHECK VALVES

Yes . . . compact, durable and dependable Williams-Hager check valves will eliminate expensive and troublesome noise in *your* piping system. Available for standard pipe sizes from 1" to 20", they operate with maximum efficiency in horizontal, vertical or angular. Send coupon for complete details.

MAIL THIS COUPON TODAY

THE WILLIAMS GAUGE CO., INC. (ME 454)
3013 Pennsylvania Avenue
Pittsburgh 33, Pa.

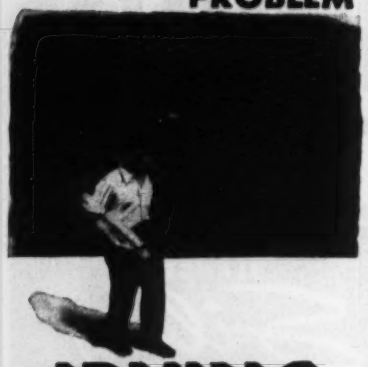
Please send a copy of Bulletin WH-851 on "Water Hammer, Cause, Effect and Control in Piping Systems."

NAME_____
TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE___ STATE_____

CHECK VALVES
THE WILLIAMS GAUGE CO., INC.
3013 Pennsylvania Ave., Pittsburgh 33, Pa.

ENGINEER

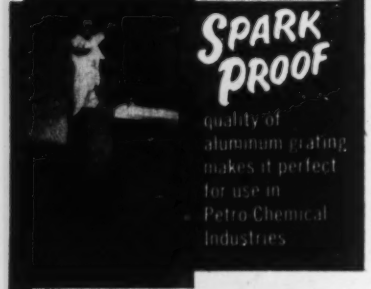
WEIGHTY PROBLEM



IRVING ALUMINUM GRATING

Irving Aluminum Grating is the solution where STRENGTH and VERY LIGHT WEIGHT are wanted.

RUST PROOF



SPARK PROOF

quality of aluminum grating makes it perfect for use in Petro Chemical Industries

For Further Information on Irving Gratings, Write

IRVING SUBWAY GRATING CO., INC.

ESTABLISHED 1902

OFFICES and PLANTS at

5010 27th St., Long Island City 1, N. Y.

1810 10th St., Oakland 20, California

YOUR New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

231 MAGNETIC SEPARATORS

Eriez Mfg. Co.—Bulletin B-604 describes Magnalarm. Magnalarms are permanent magnetic separators with ferrometer "brains" which signal automatically when tramp iron load reaches a danger point. Plate magnets, round pipe separators, pneumatic humps and gravity flow humps as well as sizes, strengths, recommended installations, features and weights are among the information listed.

232 HIGH-SPEED TOOL STEELS

Latrobe Steel Co.—Folder describes in detail high-speed tool steels with "built-in" sulphide lubricants. Explains "Built-in" lubrication, advantages. Hardness tables. Steels available in bars, forgings, drill rod, tool bits. Illustrated.

233 MULTI-STAGE PUMPS

Food Machinery & Chemical Corp., Peerless Pump Div.—Bulletin No. B-1400 describes in detail and completely illustrates with technical data a complete line of 2-, 3-, 4-, and 5-stage pumps for boosting and circulating hot and cold water and clear liquids against medium and high heads. Pumps are of split-case design and are available for capacities up to 3000 gpm. Head ranges up to 1600 ft are offered, and all types of drive.

234 GRATING-FLOORING AND TREADS

Irving Subway Grating Co., Inc.—Catalog F-225 contains illustrations, descriptions and engineering data on grating-flooring, treads, and floor armoring (riveted, press-locked, welded types) for industrial power and refinery walkways, stairways, driveways, trucking aisles; ship cat-walks and engine room floors and treads; locomotive, freight and passenger car runways and treads; roadway armoring expansion joints, catch basin covers; bridge decking.

235 POWER TRANSMISSION EQUIPMENT

Lovejoy Flexible Coupling Co.—Illustrated catalogs cover the following: Flexible Couplings, cushions changed without shutdown, no lubrication needed, 1/8 to 2500 hp. Variable-Speed Pulleys, change speed while motor is running, ratios to 3 to 1, fractional to 10 hp. Select-O-Speed Transmissions, ratios to 10 to 1, fractional to 5 hp. Universal Joints, precision-ground alloy steel, 13 sizes, bores 1/4 to 2 in., lengths 2 to 10 3/8 in.

236 PLUG NUTS

Lamson & Sessions Co.—Leaflet, illustrated, briefly lists advantages of plug nuts and how they work. They are hardened round nuts which are pressed into a punched or drilled hole of pre-determined diameter in ferrous or non-ferrous material. In any thickness of material down to .030 in. and in any tap size from #4 to 1/2 in.

237 OIL FILTERS, STRAINERS, OILING DEVICES

Wm. W. Nugent & Co., Inc.—Seven bulletins: No. 6 illustrates and describes Nugent pressure strainers; No. 7, gravity filters; No. 7A, pressure filters; No. 8, tanks, pumps, shaft oilers; No. 14 oiling and filtering systems for turbines, paper mills, steel mills, pumps, compressors; No. 15, oiling devices; No. 16, sight feed valves, multiple oilers, flow indicators, sight overflows, and compression union fittings.

238 ELECTRICAL PRECIPITATORS

Research Corp.—Illustrated General Bulletin, 28 pages, describes Cottrell theory, methods, types, and specific applications in a variety of industries, including power, steel, chemical, paper, metallurgical, gas, oil, and carbon black.

239 STEELS

Sharon Steel Corp.—Two illustrated booklets describing Sharon 430 stainless steel and Galvanite—a zinc coated weather resisting steel. Chemical analysis, typical mechanical and physical properties, and fabricating characteristics are discussed. List of typical applications is appended.

240 CLUTCHES

Borg-Warner Corp., Rockford Clutch Div.—Bulletin 4A/13 is a catalog condensation of a wide variety of types and sizes of clutches, both automotive and industrial, which also describes power take-off and gear reduction units. Illustrations are included with description and specifications.

241 INDUSTRIAL POWER AND PROCESSING EQUIPMENT

Schutte & Koerting Co.—Bulletin SK-1 lists the complete line of SK Equipment and their descriptive bulletins. Some of the general product listings include jet apparatus, pumps, condensers, valves, strainers, heat-transfer apparatus, oil-burning equipment, and instruments for indicating, controlling, and recording the flow of fluids. Special products, such as moisture eliminators and separators, are also listed.

242 FULLY CROWNED GEAR TEETH

American Flexible Coupling Co.—Seven major engineering advantages of fully crowned teeth in gear-type flexible couplings are described in a new Bulletin No. 1052. Excessive offset or angular misalignment, space limitation, high speeds, and torque loads are problems described and illustrated.

243 INDUSTRIAL SPRAY NOZZLES

Spraying Systems Co.—Catalog No. 24, a new spray nozzle catalog, contains capacity and spray characteristic data. Said to be the most complete industrial spray nozzle catalog ever produced, it illustrates nozzles for producing hollow cone, full cone, flat, solid stream, and pneumatically atomized sprays. Nozzles made of special materials are also illustrated with capacity tabulations, such as nozzles with wearing points reinforced with tungsten carbide.

244 HYDRAULIC FLUID

E. F. Houghton & Co.—Folder describes a non-flammable hydraulic fluid which claims maximum fire resistance with top hydraulic efficiency. It is said to satisfy the need for a safe, non-toxic, non-corrosive liquid that can be used in hydraulic equipment operated near open flames or adjacent to extreme heat conditions. This fluid, known as Houghto-Safe, has been under plant test for over two years and is rated as an "acceptable" hydraulic fluid from the fire hazard standpoint by the Factory Mutual Engineering Division.

245 TORQUE LIMITER

Morse Chain Co.—Catalog C14-54 describes new Morse slip-type overload protection device. Dimensional data, engineering data and special adaptation drawings are included.

VOLUNTEERS NEEDED

Ask your nearest Volunteer Bureau or Community Welfare Council how and where you can serve as a community service volunteer.

YOUR *New Catalogs* GUIDE

246 PLASTIC PIPE

Republic Steel Corp.—Catalog announces newest company product, plastic pipe. Tells why the company entered plastic pipe field, describes the two principal types, shows how to join plastic pipe and lists various engineering and corrosion data.

247 INSTRUMENTS

G. M. Giannini & Co.—3 separate catalogs will be available covering products of 3 divisions of the company. Airborne Instrument Div. catalog contains bulletins on pressure transducers, gyros, temperature probes and accelerometers with both potentiometer and inductive outputs. Digital Products catalog contains bulletins on digitizing commutators, angular position encoder kits, and digital systems. Electro-Mechanical Div. catalog contains bulletins on precision potentiometers, small motors, servo motors, syncros, "Mag-Seal" relays, pressure switches, and telemetering commutators.

248 BELT CONVEYORS

Jeffrey Mfg. Co.—Catalog #852 is handbook on subject of belt conveyors. Catalog provides complete selection of units so indexed and classified that by referring to the proper tables correct belt conveyor is easily determined. Design of belt conveyor is made easier and replacement parts are selected through the illustrations and engineering data incorporated into this catalog.

249 NYLON-LINED BEARINGS

Thomson Industries, Inc.—Folder and inserts describe advantages of nylon as a bearing material and in particular the "Nylined" principle . . . the use of nylon in thin-wall section designed for precision applications at low cost.

250 HYDRAULIC CYLINDERS

Hanna Engrg. Works—Catalog No. 233A describes high pressure cylinders for hydraulic operation for precision control of machines, presses and material movement. Tables of capacities, piston velocity, various models, mounting brackets, valves, application. Also low-pressure cylinders. Illustrated.

251 RUBBERIZED ABRASIVES

Cratex Mfg. Co.—Catalog No. 53 presents the adaptability, versatility, and application of Cratex Rubberized Abrasives, together with specifications and prices. The catalog contains a treatise on rubberized abrasives on burring, smoothing, and polishing operations and their use in industrial establishments. Cratex Rubberized Abrasives are manufactured in wheels, points, blocks, sticks, and cones for machine or manual application, in four standard "grit-types" ranging from relatively coarse to extremely fine textures.

252 CENTRIFUGAL PUMPS

Goulds Pumps, Inc.—Bulletin with illustrations, composite curves, specifications, dimensions, mechanical data describes new horizontally split case, single stage, double suction centrifugal pumps. Available in 19 sizes with capacities 200 to 6400 gpm . . . heads to 260 ft. Maximum standardization and interchangeability of parts. Flexible stuffing box permits using conventional packed box or mechanical seal.

253 INDUSTRIAL FASTENERS

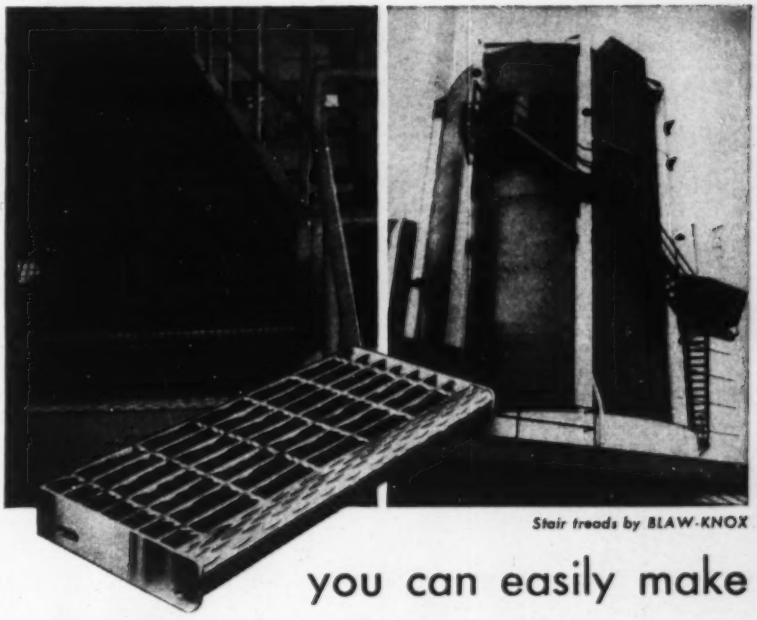
Thompson-Bremer & Co.—Bulletin covers 21 types of lock washers, also terminals, lock nuts, railroad floor clips and applications. Various finishes, type description with tables of data required for selection. Price list. Illustrated.

254 PLASTICS

Sparta Heat-Treat Co., Plastics Div.—A 4-page folder describes the features of Du Pont "Teflon," said to improve products, processes, and profits. This plastic is practically chemically inert, nonadhesive and can be used for a range of temperature of −320 F to 500 F. There is a table of typical properties of molded Teflon.

255 BALL BEARINGS

Marlin-Rockwell Corp.—Form No. 1528-6 contains list of M-R-C "Synthe-Seal" ball bearings. These are standard-dimension bearings equipped with soft synthetic rubber seals with steel cores. Well illustrated with half-tones and line cuts to show the construction of this type of ball bearing.



Stair treads by BLAW-KNOX

you can easily make

every step a safe step

Indoor or outdoor, you can rely on Blaw-Knox Stair Treads to provide the safety you want in your plant.

Designed for tremendous strength against impact, these stair treads are made with twisted cross bars and rolled diamond checkered plate nosing—as illustrated.

But, when desired, you can get treads with a twisted cross bar nosing or an abrasive nosing. And for specially slippery conditions we can supply you with serrated cross bar treads.

Just tell us what your application is and we'll offer our recommendations as to the best type of tread for your job.

Only Blaw-Knox Electroforged® Steel Grating and Stair Treads —have these five exclusive features:

1. **rigid one-piece construction—easy to install**
2. **all surfaces accessible—easy to paint**
3. **no sharp corners to clog—self-cleaning**
4. **maximum open area—for light and ventilation**
5. **non-slip twisted crossbar—safe footing**

A short note will bring you a copy of new Bulletin No. 2365-R —a dimensional sketch will bring you a quotation.

BLAW-KNOX

BLAW-KNOX COMPANY
2105 Farmers Bank Building • Pittsburgh 22, Pa.

BLAW-KNOX EQUIPMENT DIVISION
GRATING DEPARTMENT

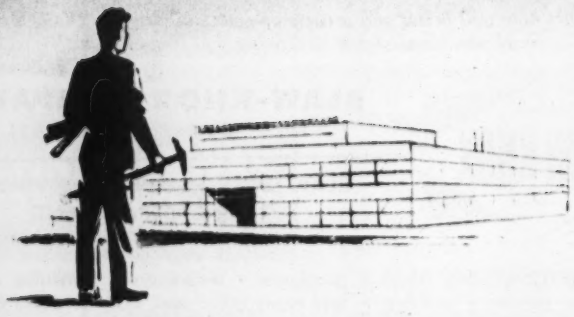
GRATING APPLICATIONS: floors • platforms • walkways • catwalks • stair treads • fan guards • shelving • and many other uses, both outdoors and indoors, for versatile steel grating.

ENGINEERS
who look ahead
Look Up!

Aeronautical Mechanical
Metallurgical Tool Design
Design

Want a real opportunity for personal growth? Then investigate the opportunities with the world's largest builder of aircraft engines. To creative engineers we can offer engineering work that can lead to professional recognition — the stability of a big company — pleasant living in colorful New England. Please send complete resume to Paul Smith, Employment Department ME4.

PRATT & WHITNEY
AIRCRAFT
Division of United Aircraft Corporation
East Hartford 8, Connecticut



256 ABSORPTION REFRIGERATING MACHINES

Carrier Corp.—6-page brochure describes new type of refrigerating machine for large scale water cooling used in air conditioning and various industrial refrigeration processes. Important features: (1) use of steam to chill water, (2) lack of moving parts, (3) lightest machine available per ton of refrigeration capacity, (4) use of water as refrigerant, (5) ability to automatically adjust from full to 10% of maximum load, (6) ease of operation.

257 AIR AND HYDRAULIC CYLINDERS

Lindberg Engrg. Co., Air & Hydraulic Div.—Bulletins 731 and 701 cover air and hydraulic cylinders. Diagram description, features, capacity, weights, types in illustration and tables. Hydraulic cylinders shown in illustrated parts, tables of capacities, types and mountings, plus pressure tables.

258 VARIABLE SPEED MOTORS

U. S. Electrical Motors, Inc.—Bulletin No. 1797, 16-pages, outlines features of variable speed motors used to improve production methods. Illustrations of "Varidrive" motors. Lists specific operational advantages and mechanical features with engineering data. Models available and their accessories are illustrated with photos, line drawings and cut-away views.

259 TUBE BENDING SERVICE

Boiler Tube Co. of America—Folder explains in detail tube bending service for straight boiler, condenser, heat exchanger and air heater tubes, both seamless steel and electric weld. List 21 types of boilers. Specialize in water wall, furnace wall and superheater tube bending. Tables of prices, working pressures, shipping weights.

260 ELECTRONIC RECORDER

Robertshaw-Fulton Controls Co., Fielden Instrument Div.—Leaflet describes "Tektolog" electronic recorder. Used for electrical quantity measuring for a variety of electrical variables. Shown as new approach to industrial instrumentation. Applications, construction and features with technical data.

261 STEEL STRAPPING

Signode Steel Strapping Co.—Color illustrated folder shows six basic ways of unitizing by varied applications of strapping. Shows pallet strapping, packaging containers, ingot palletizing. In general points up advantages of various applications of strapping in a number of handling operations. Uses and applications.

262 NICKEL ALLOYS

International Nickel Co.—"Standard Alloys for Special Problems" catalogs 18 Inco Nickel Alloys in problem-solving sections to make it easy to select the alloy with most suitable combination of alloys for a special application. Includes sections on sand and centrifugal castings, welding materials for Inco nickel alloys and cast irons, average mechanical properties and physical constants, available mill forms and Inco's precision investment casting service.

263 RECORDING ANALYZERS

Mine Safety Appliance Co.—Folder describes infrared gas and liquid analyzer for rapid automatic analysis of fluid mixtures, for precise process control and for mixing toxic contaminants in atmosphere. Other bulletins cover oxygen indicators, gas alarms and CO_2 recorders.

264 STEEL PIPE FITTINGS

H. K. Porter Co., Watson-Stillman Fittings Div.—Bulletin A3-50 describes screwed fittings, socket welding fittings, special fittings, engineering data, general information, manufacturing standards, material specifications, pressure temperatures and figure numbers. Tables. Illustrations.

265 TECHNICAL BOOKS

Lefax Publishers—Over 2000 listings of Lefax pocket-size technical books are contained in the newly revised 1954 Lefax list of technical data sheets. Condensed, mathematically accurate source materials for engineers, construction men, technical workers, and technical students. Each book consists of approximately 140 pages of easily read tables and data in pocket-size, loose-leaf form for handy reference right on the job.

Remember the trade marks "TT" and "TUBE-TURN" are applicable only to products of TUBE TURNS.

Engineered for endurance

THE TUBE-TURN Welding Neck Flange is the preferred choice for most severe piping services—resulting from high pressures, temperature extremes, or numerous fluctuations of substantial amount in either temperature or pressure or both. Due to its long-tapered hub which affords a smooth transition in thickness, the welding neck flange assembly has an endurance strength equal to that of pipe joined by butt welds.

You can fill all your requirements for Welding Fittings and Flanges from TUBE TURNS' complete line. For prompt, efficient service, call your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

The Leading Manufacturer of Welded Fittings and Flanges

TUBE TURNS LOUISVILLE 1, KENTUCKY

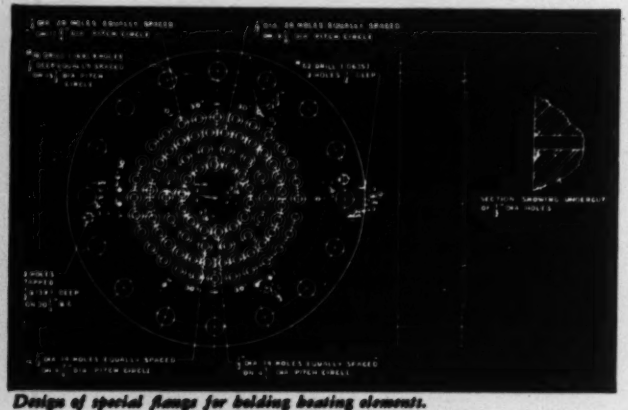
A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Chicago • Denver • Los Angeles
San Francisco • Seattle • Atlanta • Tulsa • Houston • Dallas • Midland, Texas

YOUR NEEDS *in welding fittings and flanges are met efficiently and quickly by your nearby* TUBE TURNS' *Distributor. There are more than 4000 items in the complete line of* TUBE TURNS' *products. Example: carbon steel elbows from ½" to 42" diameter as shown.*

SIMPLIFIES JOB. *The uniform wall thickness and true circularity of* TUBE-TURN *Welding Elbows makes possible accurate fit-up when cut to odd angles for jobs such as the 16" gas line shown.*

Your problems solved by TUBE TURNS' ENGINEERING SERVICE



Design of special flange for holding heating elements.

MOST FLANGE NEEDS in industrial piping are filled by TUBE TURNS' ASA line of various types, sizes and materials. However, there are many exceptions . . . "specials" such as these: (1) lens ring flanges for use at 5300 psig and 400°F, with test pressure of 10,600 psig; (2) flanges in sizes from 14" through 72" for use at 30 psig and 400°F max.; (3) 2" flanges for high vacuum service at 400°F—950°F, and (4) various complex sheet tube flanges.

A "special" example is shown at the left, developed by TUBE TURNS' Engineering Service Division for E. L. Wiegand Co., Pittsburgh. It has 84 holes for heating elements. Flanges must withstand hydrogen-nitrogen mixture at 1000 psig at 750°F and 3000 psig at atmospheric temperature.

TUBE TURNS IS AT YOUR SERVICE!

DISTRICT OFFICES

New York	Midland
Philadelphia	Tulsa
Pittsburgh	San Francisco
Cleveland	Los Angeles
Chicago	Seattle
Houston	Atlanta
Dallas	Denver

"Ⓣ" and "TUBE-TURN" Reg. U. S. Pat. Off.

TUBE TURNS, Dept. F-2
224 East Broadway, Louisville 1, Kentucky

Company name _____

Company address _____

City _____ *Zone* ____ *State* _____

Your Name _____

Position _____

TUBE TURNS

LOUISVILLE 1, KENTUCKY

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

YOUR *New Catalogs* GUIDE

266 FLUID FLOW INSTRUMENTATION

Aero Research Instrument Co.—Illustrated bulletin announces the manufacture of new and improved probes for sensing gas temperature, pressure, direction, velocity, and turbulence in and about turbo jets, ram jets, and some rocket engines. These probes are claimed to be generally less expensive units with superior performance characteristics. A research lab has been set up for special problems and facilities are available for custom-built probes for specific designs.

267 VALVES

Crane Co.—Bulletins AD 1902, AD 1936 and AD 1881 describe lip-seal bonnet globe and angle valves, 1500 and 2500 lb. for power services. Illustrations, tables. Also pressure-seal bonnet steel stop-check and gate, globe and angle valves. Union bonnet and volted steel 600 lb. small gate valves. Illustrated with tables.

268 HYDRAULIC PUMPS

New York Air Brake Co., Dudco Div.—New 4-page bulletin, No. DP-300, which points out features and gives selection data for complete line of Dudco dual-vane hydraulic pumps. Technical drawings, cut-a-way photos and performance data charts illustrate features of pumps, the first single-stage vane type pumps proven for continuous operation at pressures up to 2,000 psi.

269 GEAR MOTORS

Foote Bros. Gear & Mach. Corp.—Bulletin GMA describes line of gearmotors. Large cut-a-way illustration shows all features in detail. Illustrations of types and parts. Typical applications for a variety of equipment for a number of industries. Gearmotor application sheet.

270 INDUSTRIAL INSTRUMENTS

Leeds & Northrup Co.—4-page 2-color Folder ND46-33A(2) fully describes Model D Speedomax Console Indicator which permits an operator to record as many as 200 widely separated thermocouple temperatures as fast as he can log them.

271 MARKING TOOLS

M. E. Cunningham Co.—Bulletin J-547 describes the Cunningham line of "Safety" marking tools. It illustrates the standard line of marking devices and includes symbol charts and special codes.

272 EVAPORATORS

Lummus Co., Heat Exchanger Div.—Bulletin M-305 describes evaporators for pure water. Data and advantages. Accessory equipment. Shows bubble tray vapor purifier, mechanical vapor purifier, multiple effect and marine type evaporators. Construction, uses and applications in industry. Illustrated.

273 VALVES

Homestead Valve Mfg. Co.—Reference Book 39-3 offers complete information on Lever Seald Valves made of brass, semisteel, cast steel, and other metals for specific service conditions. Specifications for these valves, which feature "stickproof" operation, are given in charts, with photos and line drawings illustrating each type valve. Also included in this 16-page catalog are on-the-job photos of Lever Seald Valves, illustrating their many uses.

274 FLEXIBLE SHAFTING

F. W. Stewart Mfg. Corp.—Bulletin "Flexible Shaft Assemblies," describes new power drive circle Ess flexible shafting. Greater opportunity for diversified streamlined power transmission is offered for use in all types of metal, plastics, porcelain, or woodwork. They can be applied in hundreds of finished operations. Three types of power drive flexible shafts are presented—for heavy, medium, and light duty in commercial or industrial work.

275 TOOL STEELS

Vanadium-Alloys Steel Co.—One of a series of bulletins covering specific groups of tool steels manufactured by Vanadium is offered. It gives the uses, compositions, and heat treatments of the following tool steels: Colhed, Par-Exc, Silman, Mosil, Cm, Croman, Nikro M, and Speed-Cut. The booklet also discusses pertinent metallurgical characteristics.

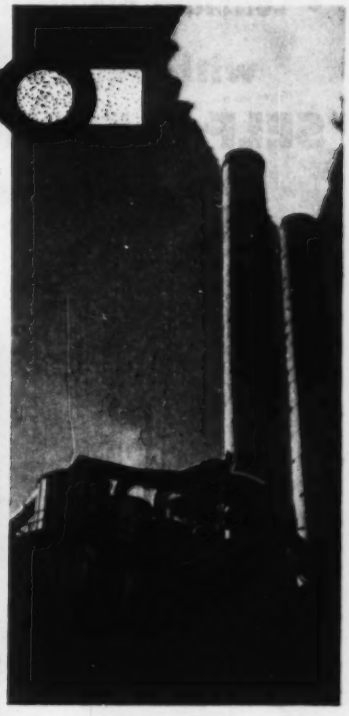
276 HEAT EXCHANGERS

Pressed Steel Tank Co., Downingtown Iron Works, Inc., Div.—Catalog contains details of heat-exchanger section, performance, mechanical design,

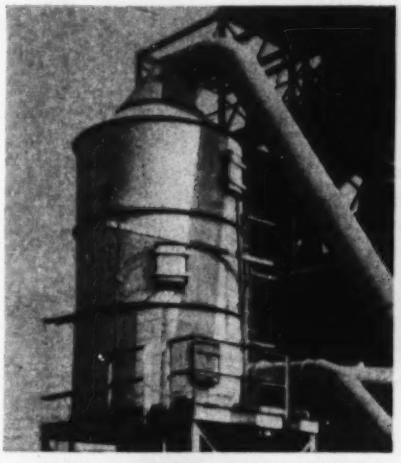
For All Fume or Dust Collection—

Norblo

brings you outstanding efficiency in three types of systems



Centrifugal



Hydraulic

Automatic Bag Type

WHATEVER your need for dust or fume control, Norblo builds rugged, efficient equipment in Centrifugal, Hydraulic and Bag type collecting systems. These three types, frequently used in certain combinations, provide economical dependable control as required in smelting, rock products, chemical, milling and processing fields.

Norblo Systems make outstanding records for high recovery with low operating and maintenance costs. Profit by Norblo's 30 years experience in heavy duty collection and Norblo development of these basic types of equipment. For good advice on dust or fume problems, consult Norblo.

The Northern Blower Company

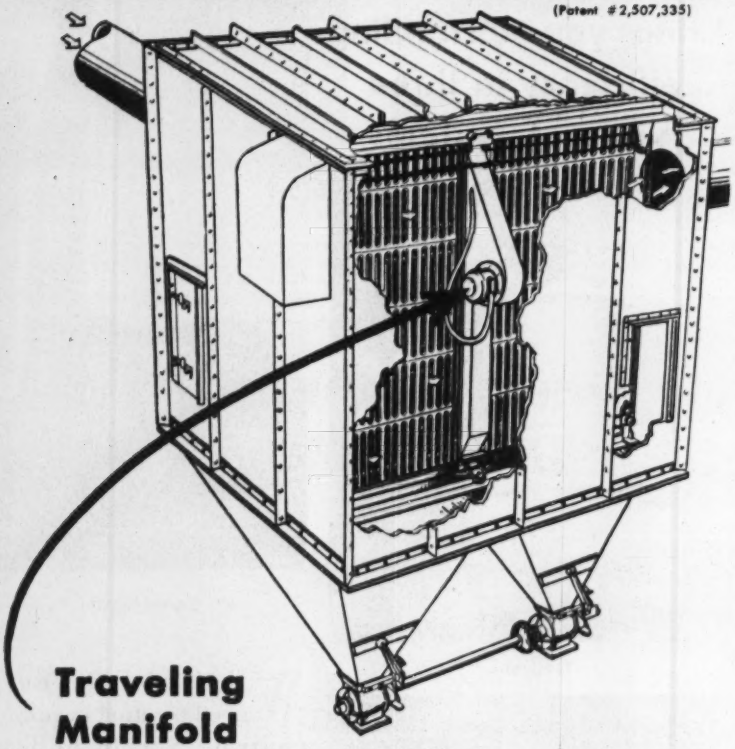
Engineered Dust Collection Systems for All Industries

6421 Barberton Ave. OLympic 1-1300 Cleveland 3, Ohio

• Continuous automatic operation
• Constant air volume and suction

with NEW PANGBORN
'SELF-CLEANING' COLLECTOR

(Patent #2,507,335)



Traveling Manifold
makes new collector self-cleaning

Now you can get continuous collector operation and constant system performance and efficiency with the new Pangborn "*Self-Cleaning*" Cloth Screen Dust Collector. Uniform air flow and resistance is assured without shutdown of the system for periodic cloth cleaning.

Write today for full details about the new Pangborn "*Self-Cleaning*" Collector that's economical to install, operate and maintain — gives you constant system performance and efficiency. Address: PANGBORN CORPORATION, 2200 Pangborn Boulevard, Hagerstown, Maryland.

Get all these important advantages

- Uniform air flow and suction
- Continuous, automatic operation
- Positive reverse air cloth cleaning
- High collection efficiency
- Reduced space requirements
- Low initial operating and maintenance costs
- Unit construction permitting flexibility of arrangement.

Pangborn DUST CONTROL

STOPS THE DUST HOG from stealing profits

PANGBORN'S 50TH ANNIVERSARY • 1904-1954

New Catalogs

tube-sheet layout with tables, illustrations, etc. A partial analysis of ASME code for unfired pressure vessels is included.

277 FLOWMETERS

Republic Flow Meters Co.—A pneumatic flowmeter for measuring widely fluctuating flows, dirty fluids, and other difficult fluids is described in a new bulletin. The flowmeter can be adapted to operate at static pressures as high as 2000 psi and differential pressure 0.6 to 704 in. water. Reading instruments may be several thousand feet from the point of measurement. Hook-ups, meter components, and applications are discussed and illustrated.

278 PROTECTIVE COATINGS

Gates Engrg. Co.—A detailed study of the performance of various protective coating systems. Results of actual field tests of eleven different protective coating systems exposed up to 83 weeks in corrosive atmosphere. Title, "A Comparative Evaluation of the Performance of Certain Protective Coatings Systems in Severe Hydrochloric Acid atmosphere." Also available is catalog on GACO N-700 liquid neoprene protective coating, including application instructions.

279 WELDING FLUXES

Krembs & Co.—Bulletin and price list on various fluxes. 26 Fluxine fluxes are described, with particular use in welding steel, aluminum, silver, etc. Included is 28H Fluxine in powdered form for gas, hydrogen, argon, or heliarc welding of stainless steel and Inconel, Fluxine No. 47, used for silver soldering on steel and Inconel also aluminum bronzes and Beryllium copper. Data on their copper welding electrodes for welding copper and all copper alloys.

280 CRUSHING HANDBOOK

Pennsylvania Crusher Co.—General booklet gives information on how to make the most efficient and satisfactory application of various types of crushers to specific jobs. It contains information on power consumption, parts wear, maintenance costs, and uniformity of product, and includes a check list that tells how to determine the best type of crusher for various jobs.

281 NUCLEAR GAGES

Industrial Nucleonics Corp.—Vol. 1, No. 1, of "Nucleonics Views" describes the use of a beta gage to control automatically the weight of rubber coating given to cord and fabric used in automobile tires. Variations in weights are detected, the correction is calculated, adjustment is made, and the process is recorded on a chart, all automatically. Gage also measures paper, plastic sheet, metal strip, and coatings.

282 PUMPS

Tri-Clover Mach. Co.—Composite, 4-section catalog covers centrifugal, sanitary, "Nofome" and industrial pumps. Selection and application data. Loss of head, viscosity and other required engineering data to enable calculation and proper selection of type of pump required.

283 METERS AND CONTROLS

Bailey Meter Co.—A comprehensive catalog, Bulletin 18, offers information on the complete line of meters, control equipment, and engineering services by Bailey Meter Co. It is written for engineers in power plants, public utilities, and process plants. Fifteen measured variables common to power and process operations form the index for selecting appropriate metering and control equipment. Basic specifications, illustrations, and detailed literature references are included.

284 ELECTRIC MOTORS

Doerr Electric Corp.—Bulletin 100 describes standard and special application designs 1/20 to 5 hp. Advantages, types for pump, brake power tool, hoist, fan. Mountings. Motor parts for built-in drives. Illustrated.

285 BOILER-WATER COLUMNS

Reliance Gauge Column Co.—New bulletin No. 516 describes boiler-water columns and gage equipment such as the original "alarm" water columns, remote reading water-level gage, liquid-level alarms, illumination equipment, gage valves, and gage cocks.

286 SOLENOIDS

Soreng Products Corp.—Leaflet describes four types of solenoids with graphs, diagrams and tables. Detail description. Advantages. Illustrated.

YOUR

New Catalogs GUIDE

287 GAGES AND INDICATORS

Ernst Water Column & Gage Co.—Bulletin 1-6-54 has been released, covering some of Ernst specialties, such as bronze, iron, and stainless steel liquid-level gages; also trycocks, illuminators, and flow indicators.

288 ELECTRIC MOTORS

Brook Motor Corp.—Folder covers single and polyphase motors, all major types in a wide hp range. Describes construction, features in cut-a-way illustration. Electrical features, mechanical features, in tabular form with illustrations.

289 STEAM GENERATORS

Preferred Utilities Mfg. Corp.—Bulletin 2000 contains a description of the principal design features of the four-pass Preferred Unit Steam Generator. A complete list of standard and accessory equipment plus a table of dimensions is also included.

290 SPRINKLER SYSTEMS

"Automatic" Sprinkler Corp. of America—"The ABC of Fire Protection" is a 36-page illustrated booklet on the advantages of installing sprinkler systems, emphasizing probable savings in insurance. Operation of various types of fire protection systems is explained and their advantages described. Photographs of buildings and ships using "Automatic" systems are included.

291 TEMPERATURE AND PRESSURE INSTRUMENTS

American Machine & Metals, Inc., Gotham Instruments Div.—Catalogs No. 100 ("Industrial Thermometers"), 200 ("Dial-Type Thermometers"), 400 ("Recorders"), and 500 ("Controllers") describe industrial and dial thermometers, and temperature and pressure recorders and controllers of both pneumatic and electric types. Specifications for all instruments are given.

292 METAL FLOATS

Arthur Harris & Co.—Catalog describes seamless copper floats for steam, oil and air traps, feedwater heaters, storage tanks, boiler water level controls, condensation receivers, etc. Construction. Tables of weights and buoyancies. Types. Stainless steel floats. Engineering data. Illustrated.

293 NON-ABSORBENT INSULATION

Insul-Mastic Corp. of America—A 32-page catalog describes a protective coating and insulation combined. It is spray applied in coating form 1/4 in. thick. It is said to stop 65 per cent of heat loss, control condensation, and prevent corrosion by repelling moisture. Temperature range −40 F to 300 F.

294 COMBUSTION EQUIPMENT

Hauck Mfg. Co.—The Catalog 52 gives a condensed and pictorial review of oil and gas combustion equipment for production, construction, and maintenance applications in industry. The catalog has 12 pages and 80 illustrations, arranged for readers' convenience.

295 CRANE SCALES

Hydroway Scales, Inc.—Describes various types of scales installed on crane hook, eliminates central weighing station. Advantages. Shows a number of types for varied application and use. Table of dimensions, capacity. Illustrated.

296 GRATING, FLOORING, STAIR TREADS

Blaw-Knox Co.—Bulletin 2365 features the Electroforging—® process of manufacturing Blaw-Knox grating and stair treads. Illustrations, charts, and descriptive data point up the strength and permanence of Electroforged, one-piece construction of grating for industry. Two pages of this 16-page bulletin include an accurate table of safe loads, sizes, and specifications for Blaw-Knox grating and stair treads.

297 CONVECTIVE ASPHALT HEATER

Todd Shipyards Corp., Combustion Equipment Div.—Bulletin describes details of combustion chamber, tubular heat exchanger and related auxiliaries. Shows how automatic, low maintenance, highly efficient unit is especially designed to heat asphalt economically thus meeting the industry's "close control" requirement.

Roth RR Rubber Molds Shock-Resistant Aircraft Transformer Case!

Easier to assemble and seal than the old-fashioned metal case, the shock-resistant rubber molding by Roth for the Jefferson Electric Company has other significant advantages: it is corrosion-resistant, oil-resistant; and it provides *complete protection* to its contents against high altitude conditions and the extremes of arctic and tropical weather. Roth engineers solved this problem—they can solve *yours!*

Engineers and Rubber Buyers!

Write for your free Roth Rubber Sampler. This unusual kit contains actual rubber samples with hardness from 5 to 100 Durometer . . gives ASTM specs and lists uses for each sample. Sorry, but offer must be limited to engineers and rubber buyers only. Please ask for Roth Rubber Sampler No. ME 4.

Custom Manufacturers of Industrial Rubber Products since 1923

RR ROTH RUBBER COMPANY

1856 S. 54th Avenue, Chicago 50

☐ Send Roth Manual
☐ Please comment on attached description of our rubber problem.

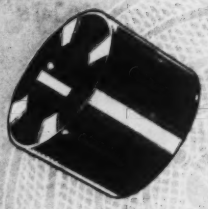
Name_____

Position_____

Company_____

Address_____

City_____ Zone_____ State_____



ARE YOU SEARCHING FOR
HIGH PERFORMANCE
BEARINGS?

GRAPHALLOY

OIL-FREE

SELF-LUBRICATING

BUSHINGS

Work Where Others Won't!

EXCELLENT DURABILITY • CONSTANT COEFFICIENT OF FRICTION • APPLICABLE OVER A WIDE TEMPERATURE RANGE — EVEN WHERE OIL SOLIDIFIES OR CARBONIZES **• OPERATE DRY, OR AT HIGH SPEEDS SUBMERGED IN WATER, GASOLINE OR OTHER LIQUIDS • EXCELLENT FOR CURRENT-CARRYING BEARINGS**

GRAPHALLOY **materials are also in wide use for oil-free, self-lubricating piston rings, seal rings, thrust washers, friction discs, pump vanes, etc.**

Other Graphalloy Products

For applications requiring low electrical noise, low and constant drop, high current density and minimum wear. Used for SELSYNS, DYNAMOTORS, SYNCHROS, ROTATING STRAIN GAGE pick-ups and many other applications. Brush Holders and Coin Silver Slip Rings also available.

GRAPHITE METALLIZING CORPORATION

1058 NEPPERHAN AVE. • Yonkers, New York

☐ Please send data on Graphalloy Oil-Free BUSHINGS.

☐ Send data on BRUSHES and CONTACTS.

NAME & TITLE

COMPANY

STREET

CITY ZONE STATE

YOUR

New Catalogs

LATEST INDUSTRIAL LITERATURE

GUIDE

298 CHAMFERING MACHINES

Modern Industrial Engineering Co.—Universal Burr-Masters for production gear deburring and chamfering are described in Bulletin 103-60. These are the first machines capable of chamfering entire tooth form of both spur and helical gears, plus external straight and involute splines. Advantages include: continuous and simple operation, rapid finishing and quick-change tooling.

299 ELECTROSTATIC PRECIPITATORS

Koppers Co., Inc., Precipitator Dept.—Folder describes Koppers Elex electrostatic precipitators in features and performance. Specific operating results are given as well as suggested applications in nuisance elimination, cleaning of process gases, or recovery of valuable products.

300 SOOT BLOWERS

Hahn-Pitz Corp.—New Bulletin No. 71 describes mechanical soot-blowers for fire-tube boilers. Adaptable to H.R.T., Scotch marine and fire-box types, these blowers have no moving parts within the boiler, with no scoring of the tube sheet. For existing boilers or new installations.

301 ELECTRIC RELAYS

Automatic Electric Co.—5 Circulars (1800-04 incl.) give engineering application data; specifications: dimensions, time range, voltages, contacts, etc., plug wiring diagrams and methods; dimensional drawings; contact spring assemblies, illustrated. Class: "A"—all purpose relay; "B"—compacted relay for all mountings and services; "F"—quick-acting AC relay functions without specified operate or release time-delays; "S"—lighter, smaller relay for aircraft and similar shock and vibration resistance; "Z"—light, small relay where timing and other requirements preclude smaller "S" relay.

302 ELECTRIC MOTORS

Robbins & Myers, Inc.—Bulletin No. 400 describes the R & M "All-Weather" motors. These motors can be installed anywhere, in any climate: in damp areas, in dusty or corrosive environment, the manufacturer declares. There are drip-proof and splash-proof polyphase motors from 1-125 hp; single-phase, 1-7½ hp; direct current, 1-7½ hp; totally enclosed, fan-cooled, 1-40 hp; and explosion-proof, 1-40 hp.

303 FLEXIBLE COUPLINGS

Poole Foundry & Machine Co.—Catalog No. 53 describes all the types and sizes of flexible couplings which they manufacture. Complete engineering data, horsepower ranges, shaft sizes, etc., are included. Several new-type disengaging couplings and the new NEMA standards are incorporated in this issue.

304 FIBERGLAS STRUCTURAL PANELS

Resolite Corp.—A new 12-page catalog describes Resolite translucent structural panels of Fiberglas-reinforced plastic, manufactured in 8 standard colors and tints. In addition to specifications, loading, and light-transmission values, and other physical characteristics of this building material, the catalog pictures suggested structural applications with detailed drawings for home or office partitions, patio covering, building facing, industrial skylighting, toilet and shower stalls, and other practical uses.

305 ELECTRIC MOTORS

Allis-Chalmers Mfg. Co.—Catalog 51B6052 is designed to help determine the electrical and mechanical characteristics desired in commonly used motors and to indicate availability of less frequently used types and larger motors that may solve more involved application problems.

306 BEARING BRONZE

Bearium Metals Corp.—Three-color, 6-page folder describes the frictional properties available in Bearium Metal and illustrates typical bar stock sizes and individual castings. Photomicrographs show structure and lead distribution achieved in production of this metal, accounting for its advantages for bearings, bushings, thrust washers, and other requirements involving rubbing friction.

307 METALWORKING MACHINES

O'Neil-Irwin Mfg. Co.—A 32-page catalog describes how Di-Acro precision metalworking machines perform a wide variety of forming, cutting, and punching operations in medium and lightweight materials. Seven basic Di-Acro machines—benders, brakes, notchers, punch presses, rod parters, rollers, and shears are available in 42 hand- and power-operated models. Machine specifications and material capacities are arranged in tabular form for reference.

308 TITANIUM ALLOY

Kennametal Inc.—Folder describes Kentanium, a new heat-resistant titanium alloy that resists thermal shock, withstands oxidation, and retains great strength at high temperatures (1800 F and above).

309 FLEXIBLE METALLIC TUBING

Pennsylvania Flexible Metallic Tubing Co.—"Flexineering," 8-page illustrated data book, explains scientific application of flexible tubing for air, oil, steam, gases, volatiles. Application photographs, engineering data on steel, bronze, and aluminum tubing and hose in many types for product designers, engineers, and equipment supervisors.

310 PRECISION FINISHING MACHINES

Heald Mach. Co.—12-page Bulletin covering complete standard line of precision finishing machines. Included in the Bulletin are pictures, descriptions and specifications of Bore-Matics, internal grinders, rotary surface grinders and tool sharpeners.

311 HYDRAULIC OIL POWER EQUIPMENT

Vickers Inc.—Catalogs 5001 and M-5101 contain general design information and specifications of a complete line of pumps, valves, controls, and related equipment for oil hydraulic power transmission in machine tool (general industrial field) and mobile equipment industries, respectively. Individual units, also standardized or custom-built power units, transmissions, and control panels.

312 MERCURY CLUTCH

Automatic Steel Products Inc., Mercury Clutch Div.—An 8-page pamphlet describes the operation of the mercury clutch and its advantages over conventional clutches. A special table and photographs illustrate the many specific applications of this automatic torque control for gasoline engines and electric motors, said to eliminate many prevailing power transmission problems. The clutch is available in two series: series G for gasoline engines from ¾ to 25 hp; series E for electric engines from ¼ hp, 1800 rpm to 25 hp, 1800 rpm.

313 TURBINE PUMP

J. S. Coffin, Jr., Co.—A 6-page illustrated Bulletin on new type "DE" turbo pump, describes the engineering of a single-stage, turbine-driven centrifugal pump with a volumetric range of 800 gpm, discharge pressures to 1,500 psig, steam pressures to 1,200 psig. (For special installations, ratings can be exceeded.) Operates on alloy-steel shaft and utilizes both speed-limiting governor and pressure regulator operating through a powerful oil relay which prevents over-speeding and provides automatic shutdown upon loss of oil.

314 MANOMETERS

Trimount Instrument Co.—Bulletin describes "Red Line" well type, absolute pressure and U-Tube manometers, also indicating flow meters, orifice flanges and orifice plates. Description of various types with tabular data on ranges and price.

315 MACHINE TOOLS

Bullard Co.—Color, well illustrated Bulletin describes horizontal boring, milling and drilling machines. Types shown are "Cut Master" and "Man-Au-Trol" vertical turret lathes, "Mult-Au-Matic" type D and K, "Contin-U-Matic" type rd and rdh, vertical chucking grinder, spacer, horizontal boring machines. Descriptions, tabular data.

316 ADJUSTABLE-SPEED DRIVES

Reliance Electric & Engrg. Co.—Bulletin D-2102 describes V-S Jr. drive. Completely packaged and all-electric, this adjustable-speed drive furnishes stepless adjustable speeds from a plant's a-c circuit. These packaged ¾ to 3 hp drives consist of an operator's control station, adjustable-speed drive motor, and control unit. Applications, functions, dimensions, characteristics, and auxiliary equipment are also presented.

317 BURNERS

Engineer Co.—Gas and/or oil burning equipment is fully described, also illustrations and specifications for fuel oil pumping and heating units are given in the new Bulletin OB-53.

YOUR

New Catalogs

GUIDE

LATEST INDUSTRIAL LITERATURE

318 NYLON GROMMETS

Illinois Tool Works, Shakeproof Div.—Bulletin describes "Plasti-Grommet" a blind screw receptacle that locks tight. Types shown in diagrams, application data, uses, and tabular dimensional data.

319 BRONZE SLEEVE BEARINGS

Bunting Brass & Bronze Co.—Standard stock industrial cast bronze sleeve bearings, bronze bars, electric-motor cast bronze sleeve bearings, and graphited oilless sleeve bearings are contained in Catalog 52. There are 854 different sizes of standard stock bearings, from $^3/_{16}$ in. to $4^1/_2$ in. ID, and 324 different electric motor bearings, as well as 263 sizes of tubular and solid bars.

320 MECHANICAL LEATHER-OIL SEALS

Chicago Rawhide Mfg. Co.—Catalog No. 551 with mechanical sealing, origin and use, types and design, size lists, bearing protection. Presented with diagrams and complete tables and descriptions. Engineering data. Another bulletin is a report on "Compor," controlled porosity mechanical leather. Technical report with diagrams, tabular data which point up features and advantages.

321 U BOLT TYPE SELF-LOCKING NUTS

Elastic Stop Nut Corp. of America—Catalog #701. Illustrated 26-page catalog on standard types of Elastic stop nuts. Contains details on how to make lock nut analysis; features and principle of self-locking device; where and how to use Elastic stop nuts and break-down on product nomenclature. Complete part listing showing availability and weight of standard hex, clinch, spline and U bolt type Elastic stop nuts.

322 INSTRUMENTS AND RECORDERS

Brush Electronics Co.—Brush oscillographs, amplifiers, acoustical instruments, and recording analyzers provide usable, permanent records on electrical, mechanical, or acoustical investigations on items such as surface finish, textile fiber uniformity, d-c or a-c voltages or currents, strains, displacements, light intensities, temperatures, and other static or dynamic conditions.

323 PLASTICS

Union Carbide & Carbon Corp., Bakelite Co. Div.—12-page reference file of plastics and resins contains 80 photographs showing applications and finished products. Data on special and general purpose phenolic, styrene, polyethylene presented in 18 categories under: molding and extrusion; wire and cable covering; bonding resins; protective coating resins; laminating; rigid sheets; film and sheeting; calendering materials. Replete with technical data.

324 UNLOADING VALVE

Waterman Engineering Co.—New unloading valve is described in leaflet for pressure systems to 3000 psi. Flow rates to 30 gpm. Available in two pressure ranges, 500–1500 psi, 1500–3000 psi, and two pipe sizes $^3/_8$ and $^3/_4$ in npt. Diagrams and application chart, flow characteristics, model number sizes and pressure range table. Illustrated.

325 SOLENOIDS

National Acme Co.—Bulletin EM-52 is a 28-page illustrated catalog of Namco "Stellite"-Welded Solenoids, designed with heavy covers and a reference tab for insertion in $8^1/_2 \times 11$-in. files. Specifications, applications, ordering instructions, engineering data, and accessories and parts lists are included.

326 SPECIALIZED EQUIPMENT

L. O. Koven & Bro.—Bulletin No. 550, color, illustrated, contains descriptions of specialized equipment manufactured such as: mixers, ketales, vacuum and pressure vessels, autoclaves, evaporators, impregnators, condensers, still, extractors, tanks, stacks, piping. Bulletin 490 describes facilities available and various plants and their equipment.

327 OIL AND GAS BURNERS

Lammert & Mann Co.—Bulletin No. 600 contains discussion on oil as a fuel, efficiency of oil and gas burners, reason for two separate burners. Description of types with full illustrations, drawings of oil or oil-gas burners. Tables of standard ratings, of oil burners, same for gas. Drawings and register of dimensions.

328 HIGH-SPEED MOTION PICTURE CAMERAS

Wollensak Optical Co.—An 8-page pamphlet describes the operation and uses of the Fastex high-speed cameras used in research, commercial engineering, and medicine. These cameras are a continuous-moving film type with rotating prism positioned between the lens and the sprocket. They are available in 8, 16, and 35 mm., in both 100- and 400-ft. capacity and are capable of taking pictures at rates of 150 to 160,000 frames per sec.

329 METAL CHIP CONVEYORS

National Conveyors Co.—New Bulletin contains illustrations, line drawings and descriptive data on "ChipVeyor" systems. Shows how metal turnings are crushed, conveyed and stored and how valuable cutting oil is reclaimed for re-use.

330 FLEXIBLE METAL FRAMING

Unistrut Products Co.—AIA File No. 14-G describes "Unistrut" a flexible all purpose metal framing. Adjustable, re-usable, no drilling or welding. Explains system, members, units, fasteners, load data, pipe and cable clamps, fittings, concrete inserts, hangers, brackets, racks, shelving. Installation illustrations and symbols.

331 BEVEL GEARS

Gleason Works—"Bevel Gear Manufacture . . . the Gleason System," by George Hessler, 16 pages, is offered as an explanation of the tools, and techniques used by Gleason for the production of bevel gears, including straight, zerol, spiral, and hypoid types. Diagrams and photographs, as well as extensive text, show these types of bevel gears and their manufacture.

332 OIL AND GAS FIRED BOILERS

S. T. Johnson Co., Mears, Kane, Ofeldt, Inc. Div.—Bulletins 2-K, 6-G, 7-D and 4-G cover line of gas, oil and combination oil and gas fired boilers from 1 to 30 hp, with the necessary automatic boiler feeds.

333 WELDING

Lincoln Electric Co.—"Elements of Weldesign" is a series of pamphlets issued periodically to design engineers, production men, and management executives. Current series outlines fundamentals of how to design with steel, how to reduce costs, and steel design fundamentals with special charts and checking information.

334 CONDENSER CIRCULATORS

C. H. Wheeler Mfg. Co., Economy Pumps, Div.—Catalog G-1050 describes double suction pumps to 54 in.; axial and mixed flow to 150,000 gpm. Designs are available for all conditions, cast or fabricated, with special materials for sea water. "Pull-out" type is also available.

335 SPEED REDUCERS AND GEAR MOTORS

Abart Gear & Machine Co.—A pocket-size catalog of Abart speed reducers, gears and right-angle gear motors. 96 pages, gives complete engineering data on how to select the proper speed reducer to fit requirements, including horsepower ratings, ratios, and installation graphs.

336 BALL AND ROLLER BEARINGS

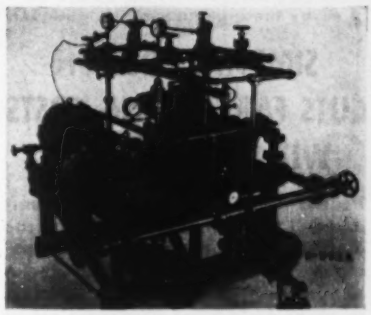
Parkersburg-Aetna Corp., Aetna Ball & Roller Bearing Co. Div.—Latest 52-page catalog gives specifications on Aetna's full line of standard ball thrust bearings, clutch release gearings, ball retainers, and hardened and ground washers. Contains technical data for design engineers, useful calculations and formulas, important application principles, fundamentals of proper lubrication, bearing selection and care.

337 HUMIDITY CONTROL

Surface Combustion Corp., Kathabar Div.—A 4-page illustrated booklet describes the features of the Kathabar system of humidity control. Schematic diagrams explain the operation of the low-temperature coil system and wiring plans demonstrate various commercial applications of this equipment. The Kathabar System is said to be the first effective method of combining chemical dehumidification with mechanical refrigeration to obtain air of extremely low dew point, and at subzero temperatures.

Now!

MORE COMPACT THAN EVER..



P-952A—Steam Turbine and Electric Motor drive gives flexibility in this compact Model P-252H size No. 25 unit.

NATIONAL AIROIL

FUEL OIL PUMPING AND HEATING UNITS

NATIONAL AIROIL Fuel Oil Pumping and Heating Units are specially designed to prepare, for combustion, all grades of fuel oil including No. 6 or Bunker "C" Oil and residuums. They will draw fuel oil from above ground or underground tanks, preheat it to proper constant temperature and deliver it to Oil Burners at an even pressure, best suited for the burners. Our Fuel Oil Pumping and Heating Units are the result of years of experience. They come completely equipped ready for steam, exhaust, condensate, oil suction, oil return, and electrical connections. All valves, regulators, etc., are readily accessible. The piping arrangement is easily understood. These compact, space-saving units are available in a range of sizes and models in both Medium and High Pressure types. For complete details, write for our Bulletin 40—very interesting and informative.

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
STEAM ATOMIZING OIL BURNERS
SLUDGE BURNERS, Steam Atomizing
MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
DUAL STAGE, Combining Steam and Mechanical Atomization
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
FUEL OIL PUMPING and HEATING UNITS
FURNACE RELIEF DOORS
OBSERVATION PORTS
SPECIAL REFRACTORY SHAPES

NATIONAL AIROIL BURNER CO., INC.

1239 East Sedgley Avenue, Philadelphia 34, Pa.
Southwestern Division:
2512 South Boulevard, Houston 6, Texas

Welded Steel Designs Cost Less because:

1. **Steel is 3 times stronger than gray iron.**
2. **Steel is 2½ times as rigid.**
3. **Steel costs a third of iron.**

Ultimate savings are limited only by the ingenuity of the designer.

SIMPLIFIES DESIGN CUTS FABRICATING COSTS WITH WELDED STEEL

Proper use of welded steel has eliminated 356 pounds of metal in the manufacture of the base for this machine. All former machining has been eliminated. There are no bolted joints to cause leakage of coolant. Cost of manufacture has been cut 20%.

First redesign to steel . . . weighed 764 pounds. Required only 31 hours to fabricate.

Final design more compact in construction, weighs 692 pounds . . . takes less floor space, requires only 24 hours to fabricate.

Original design required 1048 lbs. of castings bolted together. Each casting required costly machining and fitting.

HOW TO PUT STEEL'S SAVINGS TO WORK—

Procedures for changing over products to welded steel are presented in Lincoln Weldesign Bulletins. Available without cost to designers and production engineers by writing on your letterhead to:

THE LINCOLN ELECTRIC COMPANY
Dept. 4802
Cleveland 17, Ohio
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

YOUR New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

338 WELDING, BRAZING, STAINLESS STEELS

Republic Steel Corp.—A welding manual presents a full discussion of engineering data and operational details for welding and other methods of hot-joining stainless steels. Over 50 pages of pertinent information includes chemical analyses, mechanical and physical properties of the 300- and 400-series, classification and illustration of the various methods, and recommended data for specific operations.

339 MOTOR CONTROLS

Square D Co.—Illustrated Bulletin presents data on engineering design leadership and job engineering of custom-built motor controls. All phases of engineering and manufacturing explained which lie in back of the motor controls produced.

340 TEMPERATURE REGULATORS

Farris Stacon Corp.—Bulletin No. ST162 describes self-operating temperature regulators for steam, liquids, and gases. Principles shown, with cut-away illustration of features. Various types detailed with tables of temperature range, size, bulb diam., bulb length. Accessories shown and tables of selection of proper regulator.

341 ROTOMOTIVE EQUIPMENT

Jack & Heintz, Inc.—Bulletin No. 6014 describes Rotomotive equipment for aircraft. Tabulations present design, performance and application data on turbojet engine starters, reciprocating engine starters, a-c and d-c generators, motors, actuators, completely integrated electrical control systems.

342 VIBRATION ISOLATION PADS

Hobsite Products Co.—Bulletin on vibration isolation material. Has both elasticity and damping characteristics in proper proportion. Is easy to install and the usual loading weight is 6 pounds per sq. in. Impervious to effects of cutting oil, gasoline and diesel fuel oils.

343 STEEL TUBING

Republic Steel Corp., Steel and Tubes Div.—An 8-page bulletin lists the various types of mechanical and pressure tubing and stainless tubing, and methods used for finishing and fabricating them. In addition to design data giving chemical and mechanical properties, the pamphlet contains many illustrations of typical applications.

344 SPIRAL-WOUND GASKETS

Flexitallic Gasket Co.—Data on pipe flange gaskets and boiler gaskets using alternating plies of metal and "soft" filler given in 28-page catalog. Application, dimensions, pressure ratings, information for ordering. Shows wide variety of metals and fillers available to meet unusual conditions such as chemical corrosion.

345 LUBRICANTS

Rockwell Mfg. Co.—Bulletin No. V-220 describes lubricants, lubricant fittings, lubrication equipment and methods for Rockwell-built Nordstrom valves. Three major types of lubricant, Rockwell Hypermatic, Nordcoseal, and Lubricant DC-234, are covered, with an instruction chart showing which lubricants are recommended for use with a variety of fluids. The bulletin also illustrates and briefly describes the new Rockwell bulk and gun tube lubricants, along with stick and bulk lubricants.

346 CONTROL VALVES

Annin Co.—Bulletin 50WW describes a control valve capable of handling extremely small flows at pressures up to 50,000 psi. Use of only 2 valve seats together with adjustable stroke range of .010 to .170 provides a flow range of Cv .000001 to 0.10.

347 STOKERS

Canton Stoker Corp.—Bulletin 553, illustrated, describes Duraflex wormfeed stokers for bituminous and anthracite coal. Summary of sizes and capacities in deadplate and side ash dumping types. Also shows and illustrates kiln stokers, stokers for Scotch marine boilers, commercial anthracite, combustion control systems, conveyors for bin to boiler feeding and smoke control.

348 MOTOR CONTROLS

Allen-Bradley Co.—Sixth Edition Handy Catalog, thumb-indexed for quick selection is a 120-page booklet which contains listings for most frequently used items in their line of motor controls.

349 HEAT-TRANSFER EQUIPMENT

Trane Co.—"Extended Surface Heat Transfer Equipment," Bulletin DS-378, is available. The Bulletin describes both Trane Brazed Aluminum and Trane Fin-and-Tube heat-transfer surfaces and exchangers. It gives typical applications, performance data, working temperatures and pressures, and other engineering information.

350 GAS ANALYZERS AND RECORDERS

Cambridge Instrument Co.—Bulletin 148 BP describes dissolved O2-H2 analyzers for steam generating plants. Continuous records of the oxygen dissolved in boiler feed water and of the hydrogen entrained in steam indicate when corrective measures are necessary to prevent otherwise unsuspected and costly corrosion.

351 BOILERS

Erie City Iron Wks.—Bulletin deals with engineering design of steam generators. Describes in detail with line drawings, various types, pointing up features and advantages. Tabular data on capacities and dimensions. Also describes waste heat boilers, auxiliary equipment, water walls, superheaters, economizers, preheaters, grates, stokers.

352 TEMPERATURE REGULATOR

Powers Regulator Co.—Bulletin 308 describes construction operation of Limitem air piloted temperature control. Adjustable from 35 to 185° F. and throttling range adjustment is from ⅛ psi per 1° F. change minimum to 2 psi per 1° F. change maximum. Non-bleed design plus ruggedness and compactness. Suitable for many air conditioning and industrial applications.

353 ELECTRIC HEATING UNITS

Edwin L. Wiegand Co.—Catalog 50 covers specifications, construction details, application data, and prices of their complete line of electric heating units. Models are available with strip, ring, tubular, and cartridge heating elements. Also described are immersion, circulation, radiant, and forced-air duct heaters. Charts and tables are provided for selection of the various units.

354 COUPLINGS

John Waldron Corp.—Catalog No. 55 describes in detail gear, Francke, junior couplings and overload cut-out pulleys. Line drawings, tables of bore, hp, dimensions, weight, sizes. Full data, line drawings and illustrations, plus tables on cut-out pulleys.

355 STEAM TRAPS

Clark Mfg. Co.—Information available on new development in steam trap construction, Duo-Step Leverage. By using an ingenious double-fulcrum point and venting mechanism it is now possible to increase the drainage capacity of a trap so that it may handle twice the condensate formerly possible.

356 DRAFT GAGES

Ellison Draft Gage Co., Inc.—Bulletin 152 gives quick briefing on firm's line of diaphragm-type and bell-type straight line pointer and dial draft gages, inclined tube and vertical tube draft gages, air filter gages, portable gas analyzers, U-path steam colorimeters, saturator gages, and pitot tubes.

357 PROGRESSING-CAVITY PUMP

Robbins & Myers, Inc., Pump Div.—Bulletin 30-C describes the Moyno Progressing-Cavity Pump. A helical rotor turning within a double-helical stator provides a gentle, positive displacement that will not break up semi-solids or aerate liquids. The pump is self-priming and will not vapor-lock or cavitate. No valves or pistons are used.

358 CAPACITORS

Industrial Condenser Corp.—Catalog 1134 presents data on oil filled capacitors. Description with data on temperature range, power factor, tables of G and H series of capacity, working V.D.C. size, size of mounting neck. Illustrations and line drawings.

359 TUBE FITTINGS

Parker Appliance Co.—Catalog 4300 provides a full description of Triple-lok flare tube fittings and Ferulok flareless tube fittings, as well as tube-fabricating tools and equipment. Included are sections on use of tools and selection of tube sizes and materials according to operating conditions.

YOUR

New Catalogs

LATEST INDUSTRIAL LITERATURE

GUIDE

360 RELAYS

Guardian Electric Mfg. Co.—A group of 5 bulletins and drawings, illustrated, diagrams, drawings, tabulations on relays of many types, hermetically sealed relays: Series 200 relay with interchangeable coil and contact switch assembly, solenoids, contact switches, aircraft relays, safeguard switches for progressing machines. Separate drawing shows construction detail.

361 HOT WATER CONVERTERS

American District Steam Co., Inc.—Bulletin No. 35-77A describes converters for source of hot water for space heating. Advantages, conversion of radiation to Btu tables, selection outlined. Complete tables of dimensions, weights, prices, capacity in gallons per minute and pressure drop in feet of water give complete information on selection.

362 SPRINGS AND FORMED WIRE

Colorado Fuel & Iron Corp., Wickwire Spencer Steel Div.—48-page catalog contains information on selection and application of springs and formed wire in all types and designs. Technical data for ordering, application and utilization for all design and specifications.

363 WATER VAPOR PHYSICS

Pittsburgh Lectrodryer Corp.—Bulletin No. 218, "The Moisture in Our Atmosphere," a 12-page bulletin, discusses the fundamental physics of water vapor. The nature and behavior of water vapor are treated in a logical down-to-earth manner with psychrometric chart explanations. The use of solid adsorption equipment for dehumidification is also described.

364 WORM GEARS

Michigan Tool Co., Cone-Drive Gears Div.—Bulletin No. CD-173, 36-page, color, illustrated, presents data on how worm gearing improves design, performance, service-life and saleability of equipment. Documented are 93 successful applications in 20 different industrial classifications. Advantages listed: broad size range of standard units, simplified maintenance, compact product design.

365 SOLENOID VALVES

Automatic Switch Co.—Catalog No. 24 is a combination of bulletins dealing with large line of solenoid valves. Describe general purpose and explosion-proof 2-way midget with time delay, 3-way midget valves. Valves equipped with new solenoids for mounting in any position: "Super-Duty" 4-day with poppet-type seats and discs. Also strainers. Illustrations, diagrams, tables covering features.

366 ULTRASONIC TESTING REFLECTOSCOPE

Sperry Products, Inc.—Bulletin No. 50-105 describes applications of ultrasonic testing techniques to manufacture, non-destructive product and materials examination, quality control, and preventive maintenance through utilization of the Sperry Reflectoscope. Capable of revealing defects through 30 feet of aluminum or steel, the instrument is available by purchase, lease, or engineering service.

367 V-BELT DRIVES

Goodyear Tire & Rubber Co., Inc.—Booklet contains simplified reference tables so that the shop mechanic, farmer, or home hobbyist who wishes to design his own drive can use Goodyear belts and standard pulleys.

368 COATING AID FOR COLD FORMING

Parker Rust Proof Co.—Technical publication explains "Bonderite" as an aid in cold forming. Facilitates cold forming by treatment of steel, stainless steel or aluminum, and converts metallic surfaces to a non-metallic coating of proper texture to retain lubricant and facilitate drawing, extrusion and cold forming of metal. Also Bulletin on "Bonderite" as corrosion resistant paint base.

369 WET PIT VERTICAL PUMP

Johnston Pump Co.—Bulletin describes close-coupled vertical turbine pumps for industrial service. Can be ordered by model number from head-capacity selection charts. General data, applications, economy features. Illustrations, diagrams, charts.

370 WATERPROOF SWITCHES AND THERMAL CONTROLS

Control Products, Inc.—Basic waterproof switches for industrial and ordnance applications. Custom built actuators to specification. Also fire detectors, bearing overheat sensing units and Ultra-High temperature thermal devices.

371 VALVES

Lunkenheimer Co.—The new 500-page Lunkenheimer Catalog features a three-color illustrated Guide section, where popular valves are grouped by pressure classes for easy comparison. More complete details can be found by referring to the four-way index. Dimensions, prices, and performance data of valves are contained in the catalog.

372 HYDRAULIC SQUEEZE RIVETERS

Hanniffin Corp.—Bulletin 150, 32-pages, describes the "Hy-Power" hydraulic system for powering portable yokes or stationary units including special, customer-built multiple units for high-production forming, punching, and riveting. System is noiseless, features rapid approach and return strokes at 1,000 psi or less, shifts automatically to 5,000 psi for work stroke.

373 UNDERGROUND PIPE INSULATION

American Gilsonite Co.—Bulletin contains technical data on "Gilsulate" insulation for lifetime protection of hot underground pipes. Supplement describes facts about product with pertinent technical data: another supplement has installation specifications with plates diagramming trench sections with two pipes, expansion loop, detail at wall entry and pipe supports. Illustrated.

374 ELAPSED TIME RECORDERS

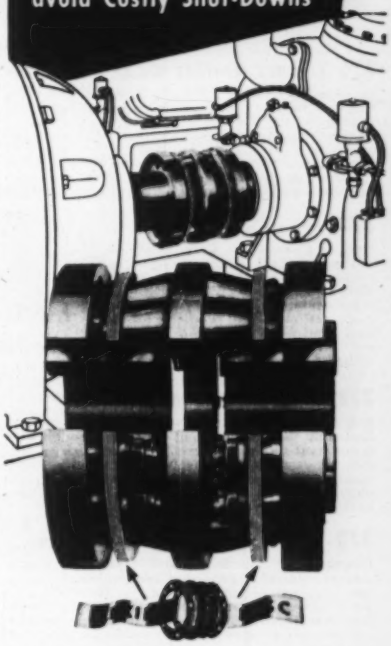
Calculagraph Co.—Automatically figure elapsed time. Print starting, finishing and total elapsed time. Provide accurate time records for all industrial operations. Permanent printed records supply exact time data for costing, estimating on reorders, etc. Bulletin F-538.

375 SLEEVE-TYPE BEARINGS

Clevite Corp., Cleveland Graphite Bronze Co. Div.—16-page catalog, "Bearings and Bushings" illustrates range and variety of products manufactured. Bushings, thrust bearings and wear plates, heavy-wall bearings, main and connecting rod bearings, aircraft engine and camshaft bearings are described and pictured, also new line of Cletex oil-impregnated, fibre-lined bushings. Also description of research and development work, and material analyses for 19 bearing alloys.

Read carefully . . . select wisely, then send coupon on page 42 now for your free catalogs. Requests limited to 25 catalogs. (Sorry, no catalog distribution can be made by us to students.)

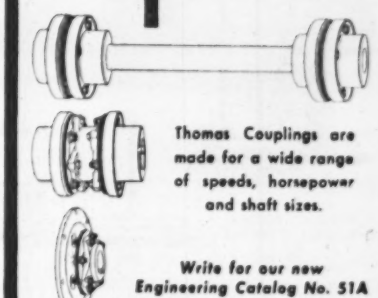
Specify THOMAS ALL METAL FLEXIBLE COUPLINGS for Power Transmission to avoid Costly Shut-Downs



Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.

DISTINCTIVE ADVANTAGES

FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



Thomas Couplings are made for a wide range of speeds, horsepower and shaft sizes.

Write for our new Engineering Catalog No. 51A

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

YOUR

New Catalogs

LATEST INDUSTRIAL LITERATURE

GUIDE

376 FLEXIBLE FURNACE WALLS

Bigelow-Liptak Corp.—Catalog describes history of thin-wall furnace construction concept design suited to medium and low temperature operation. Shows features, materials of construction and line drawings with illustrations. Application for boiler confection areas, combination with thick walls, dryer furnaces, curved refinery vessels. Other bulletin describes castable refractory.

377 PIPE HANGERS

Bergen Pipesupport Corp.—Catalog No. 531 describes constant and variable pipe supports and standard hanger assemblies. In numerous sizes, wide range of loads and travels. Operation, sizes, installation, visible reading, maintenance, hydrostatic test stops and safety factor data. Tables on loads, rod diam. dimensions, housing, rod take-out, etc. Many diagrams and line drawings of various installations.

378 INVESTMENT CASTINGS

Precision Metalsmiths, Inc.—"Pour Yourself an Assembly With Investment Castings" explains the investment-casting process. Illustrations of the difficult castings that can be made by the investment-casting process and a step-by-step description of the procedures used by the company are included in the 8-page booklet.

379 PUMPS, MOTORS, AND ACCESSORIES

Oilgear Co.—Bulletin 10051-C illustrates and describes a line of Fluid Power pumps, motors, transmissions, cylinders, and valves. It features an expanded line of variable and constant delivery pumps for operation at higher speeds, 1-hp variable-delivery pumps, constant-delivery duplex pumps for pressures up to 5000 psi, and a larger-capacity feed pump.

380 PRESSURE VESSELS

Scaife Co.—Pressure vessels for air, water, and gases are illustrated and described. Data for both horizontal and vertical types are given.

381 CENTRALIZED LUBRICATION SYSTEMS

Farval Corp.—New Bulletin No. 26 provides a complete explanation of the Farval Dualine System of Centralized Lubrication and its advantages as a means of saving oiling labor, lubricant, bearing, expense, and production time for various types of heavy industrial equipment. Its 20 pages are illustrated with photographs, drawings, and diagrams.

382 AUTOMATIC VALVES

A. W. Cash Valve Mfg. Corp.—60-page catalog describes and illustrates line of pressure reducing and regulating valves, relief valves, back pressure valves, vacuum regulators and vacuum breakers, differential pressure regulators, strainers, and diaphragm operated control valves. Contains 16 new items not previously included in former catalogs.

383 WIRE THREAD INSERT USES

Heli-Coil Corp.—Bulletin No. 652 shows uses of wire screw thread inserts in design, production salvage and maintenance. Specifications for inserts covering Class 2, 2B, 3 and 3B fits. Illustrations, line drawings, text tables explain wire screw thread insert use in all materials. Engineering information on design data, hand and power tools, taps, gages, and minimum drilling and tapping depths. Specifications in the National and Unified Thread Series, Automotive Spark Plug Thread Series, Aviation Spark Plug Thread Series and Taper Pipe Thread Series.

384 FLEXIBLE SHAFTS

Stow Mfg. Co.—Engineering Bulletin No. 525 and Slide Torque Calculator show how to select the correct size and type power-drive flexible shafts for any application (maximum capacity 1500 lb-in.). Also given is the necessary data for selecting remote-control flexible shafts (maximum capacity 4000 lb-in.).

385 COUNTERPOISE PIPE HANGER

National Valve & Mfg. Co.—Bulletin 153 describes and illustrates the Navco Counterpoise Pipe Hanger used in steam generating stations, refineries, and chemical plants. Said to be the first accurate and efficient support for high-temperature piping systems, its features permit flexibility of installation, a saving in space, and a minimization of the friction problem. The Navco Counterpoise Pipe Hanger is available in 16 frame sizes with load capacity from 200 to 16,000 lb and expansion travels up to 12 in.

386 THERMOSTATIC BIMETALS

W. M. Chace Co.—36-page illustrated booklet describes and explains 22 uses of bimetal as actuating elements in temperature responsive devices. Ten pages of engineering data for element design and selection.

387 REMOTE CONTROL VALVES

Harvill Corp., Tork-Master Div.—Illustrated brochure on "Tork-Master" automatic valve operators. General specifications and engineering data on "Tork-Master" units for remote control operation of valves from 2½-in. up. Unique design permits easy mounting on valves in service or new valve installations for petroleum, chemical, utility, etc., industries.

388 LUBRICATING SYSTEM

Trabon Engineering Corp.—Bulletin No. E463 describes operating principles and engineering data on type M and MX oil and grease systems for all types of machinery. Fully hydraulic positive-piston-type valves measure lubricant in volumes from 0.010 to 0.15 cu. in., use no springs or ball check valves.

389 ALLOWABLE STRESSES FOR PRESSURE VESSELS AND PIPING

Taylor Forge & Pipe Works—The first issue of "Taylor Forge," Vol. 1, No. 1, June, 1953, features reproductions of the allowable stress tables from the ASME Boiler and Pressure Vessel Code and the ASA Piping Code, as well as outlines of the bases on which they were prepared. Included are: Table P-7 from 1952 Power Boilers (Sec. I); Tables UCS-23, UHA-23 and UNF-23 from 1952 Unfired Pressure Vessels (Sec. VIII); Tables 3, 3A, 21, 34 and 34A from Code for Pressure Piping (ASA B31.1-1951 with supplement No. 1 ASA B31.1a-1953). Reviews of recent literature and Standards in the fields of piping and pressure vessels are included, together with information about Taylor Forge and its products.

390 ADJUSTABLE PIPE HANGERS

Blaw-Knox Construction Co., Power Piping Div.—New 100-page Catalog 51 features the Blaw-Knox functional spring hangers, vibration eliminators, and overhead roller assemblies. The improving and simplification of complicated piping systems is explained by charts and drawings. A Technical Section enables a piping engineer to solve most hanger load problems and thus determine the hanger requirements for the particular piping under consideration.

391 BOILERS AND STOKERS

James Leffel & Co.—A 28-page Bulletin No. 236, describes 6-hp and 250-hp (these are normal and conservative ratings and are subject to considerable overload capacities) Leffel Scotch-type boilers and underfeed stokers. Photos and cutaway drawings show design and application details. Test results, case studies, and specification data are included. The Leffel automatic underfed stoker is also suitable for other makes of Scotch-type boilers.

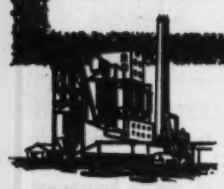
392 MULTI-STAGE STEAM TURBINES

Murray Iron Works Co.—Bulletin T-122 describes Type UV multi-stage mechanital drive turbine for driving pumps, compressors, fans, blowers and any other mechanical drive. Available in from two to ten pressure stages and with a great many possible governor combinations. Units can be furnished with wide range of accessory equipment. For capac-

Industry looks to

RESEARCH CORPORATION

for high dust collection efficiencies



POWER PLANTS

CHEMICAL PROCESS AND STEEL INDUSTRY

To maintain visually clean stacks at all times, industry is turning to the long experience of Research Corporation in the design and manufacture of highly efficient Cottrell Electrical Precipitators. We've spent 40 years in solving such problems as nuisance abatement, cleaning gas for subsequent use and recovering materials of value. Write for illustrated bulletin describing a wide range of electrical precipitator applications.

PULP AND PAPER INDUSTRY

RESEARCH CORPORATION

405 Lexington Ave., New York 17, New York

122 South Michigan Ave., Chicago 3, Illinois

Bound Brook, N. J. • *Grant Building, Pittsburgh 19, Pa.*

YOUR

New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

ities up to 2500 hp and steam conditions up to 600#, 750° F. TT., either condensing or non-condensing.

393 INDUSTRIAL SCALES

Toledo Scale Co.—A condensed catalog of the 1953 line of Toledo Industrial Scales illustrates and describes briefly the full range of fan, bench, portable, floor, motor truck, and overhead type of scales. It also covers counting scales and comparative reference data to facilitate selection.

394 MACHINE TOOL CONTROLS

Turchan Follower Mach. Co.—Catalog describes hydraulic duplicating equipment for machine tools, which makes them automatic. Principles explained and diagrams show control systems. Data on operation, illustrations on applications to various tools. Shows lathe attachments, also milling machines and other industrial tools.

395 HEAT TREATING

Leeds & Northrup Co.—New 12-page Catalog TD2-620(1) describes how L&N Steam Homo furnaces for steam atmosphere tempering, annealing and stress-relieving are providing scale-free heat-treating of both ferrous and non-ferrous parts at temperatures to 1150 F.

396 CENTRIFUGAL BLOWERS AND EXHAUSTERS

U. S. Hoffman Machinery Corp.—New Bulletin A-932 describes design and performance features of the Hoffman multi-stage centrifugal blowers and exhausters for 1 to 9 psi pressures or vacuum from 2 to 12 in. of mercury. It lists 17 industrial applications including several on which savings can be made by replacing high-cost compressed air formerly considered necessary. Also included are typical performance curves and data check lists for optimum blower or exhauster specifications.

397 INSULATING WOOL

Glass Fibers, Inc.—A 4-page illustrated booklet outlines the advantages of Microlite Insulating Wool, a low-density, resilient insulating material with high thermal-efficiency and sound-absorption characteristics. Resistant to heat, fire, moisture, and corrosion, this glass fiber insulating wool is recommended where the greatest thermal and acoustical efficiency is desirable in the smallest space. Tables are included on thermal and acoustical performance.

398 OIL BURNERS

Cleaver-Brooks Co.—Oil Burner Catalog No. AD-102 includes a description of the Hev-E-Oil Burners for industrial, commercial, and institutional installations. The catalog lists features, shows typical installations and applications, covers design construction and efficiency, and contains brief capacity and dimension listing.

399 GROOVING TOOL

Waldes Kohinoor, Inc.—Catalog No. GT2-53 presents general information, engineering specifications, and manufacturing technical data for the Waldes Truarc grooving tool. The manual is illustrated with a number of tool setups and explains the functioning of the tool, particularly its economic performance on recessing operations. It also includes typical applications, dimension and conversion tables, and ordering specifications.

400 PRESSURE AND MECHANICAL TUBING

Copperweld Steel Co., Ohio Seamless Tube Div.—An 8-page folder describes and illustrates typical usages of seamless or welded pressure and mechanical tubing. It includes dimension tables and examples of the special fabrications and finishes possible.

401 CAST STEEL GATE VALVES

Edward Valves, Inc.—A new 6-page catalog section contains complete information on details of design, material specifications, pressure and temperature ratings, and dimensional details and weights of a new line of cast steel gate valves. Features of gate valves described include close-fitting guide ribs, one-piece bonnets, and ball bearing yokes. A special testing procedure designed to assure two tight-fitting faces is also described. Items cataloged include cast steel gate valves in 300-, 600-, 900-, and 1500-lb sp classes. Ali are furnished in sizes from 2½ in. through 12 in. Flanged or welding ends are provided.

402 GAGES

American Machine & Metals, Inc., U. S. Gauge Div.—Catalog 64 provides 68 pages of illustrated information describing air-volume controls for pump installations, vapor-tension thermometers, d-c ammeters and voltmeters, water flow meters and gages of all types. Engineering information is included.

403 FLEXIBLE-SHAFT POWER DRIVES

Elliott Mfg. Co.—Catalog No. 221 describes applications of flexible shafts for power drives and heavy-duty power drives. It gives factors which determine specifications and primary requirements in engineering flexible-shaft power drives. It lists information required by Elliott engineering service in offering solutions to power transmission problems, without cost or obligation.

404 TORQUE-TESTING FIXTURE

P. A. Sturtevant Co.—A new torque-testing fixture for making ultimate-torsional-strength tests, open-hole torque tests, and driving and stripping tests of various types of screws is described in Bulletin TTF-53. Applications, such as checking strength and thread-cutting ability of taps, and strength of screw-driver bits and socket wrenches, and complete specifications are given. Special-application testing fixtures, SPT Model Push-Off Fixture, SPT Model Sensitive Compression Tester, SPT Model Hair-Spring Torsion Tester, etc., are included in the bulletin.

For Consulting Engineers

Turn to Page 146

405 PACKINGS

United States Rubber Co.—Complete catalog covers recommendation charts, describes sheet packings, gaskets, rod and plunger packings, hydraulic, flax, jute and ramic, locomotive and specialized packings. Also pump valves, miscellaneous packings. Fully illustrated. Tables and engineering section. Index covers entire line.

406 FLEXIBLE METAL HOSE

Flexonics Corp.—A 32-page illustrated Catalog CMH-130 on all types of Chicago Metal Hose covers the full range of the company's Rex-Weld corrugated flexible metal hose, Rex-Tube convoluted-hose types, and Rex-Flex stainless-steel flexible metal hose. Complete specification data are given. Also covered are coupling types, special assemblies, and installation information.

407 DROP FORGINGS

Drop Forging Association—"Metal Quality—Hot Working Improves the Properties of Metal," a 64-page booklet recently revised and issued by the Technical Committee, Drop Forging Association, for design engineers, metallurgists, and production-management executives, explains how hot working improves metal quality. The text describes forging quality steel and details of the various methods of forging. Check lists of the advantages obtained by use of forgings, economic benefits, are included.

408 SNAP RINGS AND LOCK WASHERS

Eaton Mfg. Co.—Catalog describes designs and applications of their complete line of (1) snap, bearing, lock, and retainer rings; (2) spring lock washers preassembled on bolts or screws, also self-tapping types; and (3) spring lock washers. Also included are tables of dimension specifications, and installation instructions.

WANTED!

PUMPING JOBS NOBODY ELSE WANTS!

You can buy lots of good pumps for ordinary pumping jobs, *but* NAGLE PUMPS are built to survive in those applications where ordinary pumps fail.

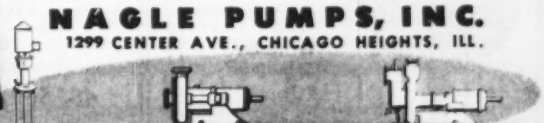
If you must pump highly abrasive mixtures, corrosive liquids, hot solutions or heavy slurries, then you will save by using NAGLE CENTRIFUGAL PUMPS. Engineered to your specific requirements—The right design, the right materials of construction. Horizontal and vertical shaft types in complete range of sizes. Send for Catalog 5206.

• Modified type "SW-O" vertical shaft pump built by Nagle for severe service in an atomic energy plant.

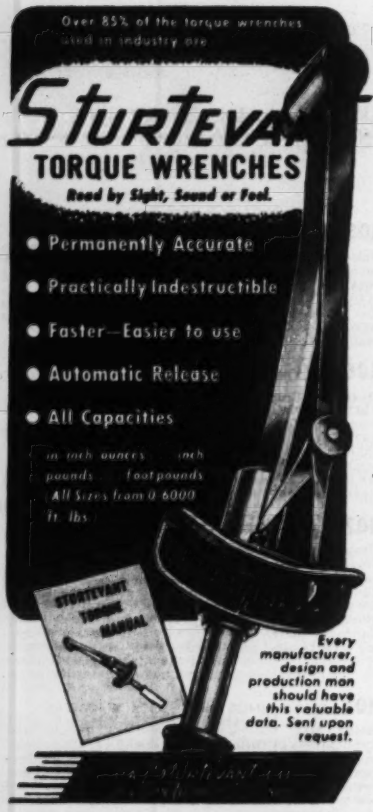
NAGLE PUMPS

NAGLE PUMPS, INC.

1299 CENTER AVE., CHICAGO HEIGHTS, ILL.



PUMPS FOR ABRASIVE AND CORROSIVE APPLICATIONS


Over 85% of the torque wrenches used in industry are
STURTEVANT
TORQUE WRENCHES
Read by Sight, Sound or Feel.
• Permanently Accurate
• Practically Indestructible
• Faster—Easier to use
• Automatic Release
• All Capacities
in inch ounces inch pounds foot pounds
All Sizes from 0 6000 ft. lbs.
STURTEVANT TORQUE MANUAL
Every manufacturer, design and production man should have this valuable data. Sent upon request.

ONE CONTROL DOES THE JOB OF TWO

Mercoid DA-400 Series Pressure Controls incorporate a single bourdon tube which actuates two independently adjustable Mercoid magnet operated mercury switches to accomplish various circuit operations. For example:

1. Close one alarm circuit at high pressure and another at low pressure with both circuits open over operating range.
2. As an electrical interlock to open one circuit as pressure rises above and the second circuit as the pressure drops below operating range.
3. To provide two-stage control by opening or closing one circuit on a rise in pressure and the second circuit on a further rise in pressure.

Ranges 0-30" to 300-2500 psi

Write for Bulletin 5P

New Catalogs

409 FLEXIBLE COUPLINGS

Falk Corp.—Bulletin 4100-1953 consolidates information about all types of Steelflex couplings by Falk. A foldout bound into the middle of the book explains the Steelflex design, and the rest of the book is devoted to technical data for use in selecting the proper coupling for different applications, whether it is the standard Type F or a special or dual-purpose coupling.

410 INDUCTION HEATING

Ohio Crankshaft Co., Tocco Div.—New catalog 22, 20 pages, describes the principles, applications, and equipment of Tocco induction heating. Typical results of induction hardening and heat-treating, and results of induction heating for forming and forging are given.

411 SPUN END PROCESS

Calumet & Hecla, Inc., Wolverine Tube Div.—Brochure describes the distinctive Spun End Process. In 28 pages it tells a concise story of a revolutionary metal-forming process that is highly efficient and relatively inexpensive. A quick comprehension of the process is gained through the many photographs, diagrams, and descriptions that make comparisons between old and new methods.

412 FORCE-MEASURING DEVICE

Hagan Corp.—The Hagan "ThrusTorq," air-operated force-measuring device, is pictured and described in Bulletin No. 9345. The ThrusTorq is employed in engine-testing laboratories, engine and aircraft factories, automotive and petroleum industry laboratories and plants, and in chemical and other plants for continuous and intermittent weighing applications.

413 METAL BENDING

O'Neil-Irwin Mfg. Co.—The 32-page bending manual contains information on a wide variety of forming operations. The bending of tubing, angle, channel, and extrusions as well as solid materials is graphically illustrated. Detailed prints show the exact manner in which any rotary-type bending machine can be tooled for precision bending. The manual outlines the recommended steps in designing parts to be formed, choice of materials, and selection of bending equipment.

414 A-C MOTORS

Reliance Electric & Engrg. Co.—Bulletin B-2102 is designed to help in selection of both the new and current line of a-c squirrel-cage induction motors for applications from 1 to 200 hp. The selector catalog points out advantages that motors offer in pre-lubricated bearing design, heavier bearing-to-bearing shafts, indestructible pressure-cast rotors, and shock resistant frames. Construction features, selection data, dimensions, prices, and ordering instructions are presented.

415 BLADELESS SEWAGE AND TRASH-PUMP

Fairbanks, Morse & Co.—Bulletin 5400K-1 describes the new Fairbanks-Morse bladeless sewage and trash pump, utilizing a single-passage bladeless impeller. Cutaway views and descriptive text explain the details of construction of the pump, both horizontal- and vertical-shaft models. Dimensions, specifications, and characteristics are given.

Additional Opportunities for positions are offered among the display advertisements on pages 48, 56, 76, 64 and 138.

AIRCRAFT ENGINEERS
With Experience
WANTED AT
GRUMMAN

LAYOUT DESIGNERS
Airframe Structures
Equipment Installations

FLIGHT TESTING
Planners
Analysts

HYDRAULICS
Systems Design
Testing

STRUCTURES
Stress Analysis
Static Testing

RESEARCH
Computer Engrs-IBM & REAC
Vibration & Flutter Engrs
Dynamic Analysis-Systems Engrs

ARMAMENT INSTALLATION
AERODYNAMICS
INSTRUMENTATION

TOOL ENGINEERS
FORM DIE DESIGNERS

Recent Graduates with Aeronautical, Mechanical, Civil or Engineering Physics Degrees may qualify.

Proof of U. S. Citizenship Required

APPLY IN PERSON
OR SEND RÉSUMÉ TO:
Engineering Personnel Dept.
INTERVIEWS AT
Employment Office
South Oyster Bay Road,
North of Railroad

Monday thru Friday
8:30–11:30 AM; 1:30–3:30 PM

GRUMMAN AIRCRAFT
Engineering Corp.
Bethpage, N. Y.

YOUR

New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

416 SLEEVE BEARINGS

Johnson Bronze Co.—A series of sleeve bearing data sheets discusses such subjects as powder metallurgy, lubrication, conformability, clearances, standard tests, load-carrying capacity, corrosion, and alloys, and their consideration in sleeve bearings. Special sleeve bearings are included on the sheets.

417 ROLLER CHAIN SRPOCKETS

Diamond Chain Co., Inc.—Catalog #753 lists prices, over 300 sizes of assorted popular bore chain sprockets complete with keyway and set screw. Removable taper bushing design is also available in larger sizes.

418 BIN LEVEL INDICATOR

Bin-Dicator Co.—New 1954 catalog fully describes and illustrates bin level indicator which gives automatic control of machinery in response to fluctuating level of materials in silos, bins, hoppers, conveyers, etc. Dimensional drawings, mounting details, typical applications, wiring diagrams, and list of present users. Illustrated applications to stoker operation, flour packing, chemical proportioning, concrete mixing plant, packaging ores, salt, feed, chemicals, candy, etc.

419 TURBINE PUMPS

Deming Co.—Bulletin No. 4700-51, shows construction details and various types of drive of turbine pumps. Used for pumping water supply from deep wells for all types of industries. Furnished for wells with inside diameter of 4 in. or larger. Capacities from 12 to 3500 gpm. Any combination of capacity, head and speed can be obtained.

420 FLEXIBLE COUPLING

Ajax Flexible Co., Inc.—Bulletin 52 describes a new spline or gear-type coupling designed to handle more shaft misalignment than conventional flexible couples. The bulletin includes dimension tables, engineering diagrams, service factors, and ordering specifications.

421 VALVES

Crane Co.—Bulletins AD 1977 and AD 1976 describe 300 lb. heavy duty all-iron globe, angle, expansion and check valves. Also all-iron relief valves, liquid gauges and fittings and flanges. Also forged steel globe and angle valves, screwed and flanged ends. Descriptive data, prices and sizes. Illustrated.

422 GEARMOTOR DATA

Elliott Co., Crocker-Wheeler Div.—Gearmotor Data Book No. 18 offers complete data covering types, applications, from 1 to 150 hp gearmotors. Hand indexed for reference notes, selection procedure, pricing procedure, complete tabular ordering data, integral additions, modifications, ratings, single, double, triple reduction. Net and shipping weights. Illustrated.

423 DUST COLLECTORS

Fly Ash Arrester Corp.—Illustrated folder on multi cyclone dust collectors. Collector furnished in completely shop assembled package units. For gas cleaning. Bodies, discharge tubes, casing and hoppers fabricated of heavy steel plate with welded construction. Top vanes and discharge cones are heavy iron castings, easily removable. Solids escape through an annular slot at base of cone, out of vortex area, reducing re-entrainment of dust to minimum.

424 MARKING DEVICES

New Method Steel Stamps, Inc.—Catalog NM-51 (with supplements) contains information on the complete line of marking devices. Included are interchangeable type holders, custom made markers, automatic roll markers for automatic screw machines, and inspectors' code symbol and hand stamps. Action photographs and line drawings help to tell the marking story.

425 CAM CLUTCH

Morse Chain Co.—Catalog C11-54 describes new line of cam clutches for over-running indexing and backstop applications. Catalog describes cam principle, gives complete dimensional and engineering data as well as various adaptations of this line of clutches.

426 PRECISION TOOLS

Lufkin Rule Co.—Catalog No. 7 has data on micrometers, micrometer calipers, heads, thread comparators, depth gages, combination squares, bevel protractors, rule clamps, squares, universal indicators, calipers, blocks and clamps, pin vises, punches, steel rules. Full data, illustrations, prices. Also data on magnetic tools.

427 OSCILLOGRAPHIC RECORDING SYSTEM

Sanborn Co.—38-page catalog describes oscillographic recording systems and accessories. Illustrations, technical data and specifications included for four, two and one channel recorders and for the versatile new "150" series system.

428 SUMP PUMPS

American-Marsh Pumps, Inc.—Comprehensive eight-page bulletin 325-A for engineers, architects and contractors who specify sewage and sump pumps. Describes three types of pumps: NKS Vertical Wet Pit Single or Duplex; NKV Vertical Dry Pit; and NKH Horizontal. Complete specifications given for all types and optional equipment is illustrated and explained. Performance tables according to pump capacity and detailed help is given for selecting correct pump.

429 MOTORS

General Electric Co.—Catalogs available on new Tri/Clad '55' motor in NEMA 182 and 184 frame sizes. Bulletin GEA-6013 on Tri/Clad '55' drip-proof motors, GEA-6012 on enclosed motors, GEA-6027 on gearmotors.

430 BALL BEARING SWIVEL FITTING

Emsco Mfg. Co.—Catalog No. FS-101 describes free turning ball bearing swivel fittings designed for liquids, gases, steam, and chemicals. Hot or cold service. Continuous or occasional rotation 360° free rotation-1, 2 and 3 planes fittings and pressures to 15,000 psi and temperatures 750° F. Over 500 sizes, types, styles. Low pressure fittings ³/₈ in. to 14 in. High pressure and high temperature ¹/₄ in. to 6 in.

431 MATERIALS HANDLING

Western Gear Works—Bulletin on "Tug-Bar." Crated, skidded or wheeled loads are easily pushed or pulled by means of traction applied to the powered front wheels. Tug-Bar is used in loading trucks, trailers, freight cars, steamship holds, aircraft, moving mail trucks and other non-powered portable freight trucks, etc. Available with 110 volt a-c 60 cycle or 24-28 volt d-c motors.

432 HIGH STRENGTH, LOW-ALLOY STEEL

Bethlehem Steel Co.—New 66-page catalog, "Mayari R—Bethlehem's High Strength Corrosion Resisting Steel," describes properties and features of this steel. Included also are photographs showing use of Mayari R in industrial and construction industry equipment; in bridges, pipe and penstocks, and in mining, transportation, and other industrial fields.

433 TECHNICAL BOOKS

The American Society of Mechanical Engineers—1954 Catalog of ASME Publications is a 20-page descriptive price list of current books, standards codes, research reports, and periodicals published by the Society.

434 VACUUM AND PRESSURE PUMPS

Leiman Bros., Inc.—Catalog 953 gives complete data on full line including 29.9 in. vacuum pumps, 25 psi pressure pumps, air motors (5 hp) and gas boosters. Also features the patented automatic E113 oiler, the use of ball bearings and illustrates various type units available.

a Bigger, Better WISCONSIN
HEAVY-DUTY Air-Cooled
ENGINE
4-Cylinder, V-Type
Model VG4D
25 to 36 Horsepower
MORE Power TO FIT THE MACHINE
MORE Power TO FIT THE JOB
One of the outstanding performance characteristics of this fine engine is its exceptionally smooth running. Among other things, this is accomplished by means of accurately balanced weights, forged to the cheeks of the crankshaft, counter-balancing reciprocating forces in the connecting rods and pistons.
This engine is regularly furnished with Stellite exhaust valves and valve seat inserts, with positive type valve rotators — highly desirable for prolonging the life of valves and greatly reducing the frequency of valve servicing. Rotators cause a slow rotation of valve during time it is lifted off its seat by the camshaft, providing new positioning every time the valve seats, assuring uniform wear and retarding lead or carbon build-up.
For equipment requiring 25 to 36 hp., specify the Wisconsin Heavy-Duty AIR-COOLED Model VG4D. Detailed engineering data gladly supplied.
MOST H.P. HOURS
WISCONSIN MOTOR CORPORATION
World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 46, WISCONSIN

YOUR

New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

435 SCREWDRIVER BITS

Apex Machine & Tool Co.—Catalog 21 has complete information on screwdriving tools. Power bits and insert bits for Phillips, Frearson (Reed & Prince), slotted, clutch head and socket screws, bit holders, magnetic bit holders and hand drivers for Phillips, Frearson and clutch head bits are shown. Hand brace bits, offset drivers, square drive sockets and finder sleeve assemblies detailed. All items priced.

436 LOAD, TORQUE AND FLUID PRESSURE MEASUREMENT

Baldwin-Lima-Hamilton Corp.—A new 20-page introductory bulletin describes Baldwin SR-4 devices and how you can use them, when a physical force must be measured or controlled quickly, accurately, remotely.

437 LUBRICANT DATA

Fiske Bros. Refining Co., Lubriplate Div.—1954 edition of The Lubriplate Data Book to all who are interested in subject of proper lubrication of all types of machinery. This new Data Book is 8-12 x 11" in size and contains 36 pages of valuable data pertaining to improvement of machine operation, reduction of power consumption and lowest possible maintenance costs through the use of specialized time tested lubricants.

438 INDUSTRIAL SPRINGS

Henry Miller Spring & Mfg. Co.—Booklet shows examples of springs, equipment and facilities. Railroad, coke ovens, mine cars, tractors, presses, shears and for other uses in industry. Illustrations of various springs and applications. Helical carbon-steel spring formula ARA and test loads in pounds and deflection perturn table.

439 HYDRAULIC PUMPS

American Engineering Co.—Two bulletins on high pressure fluid power pumps. (1) Hydramite Bulletin No. 3 describes constant-displacement oil fluid power pump capable of delivering 3, 5, and 10 gallons per minute at pressures up to 5000 psi (2) Hele-Shaw Bulletin No. 2 describes variable stroke pump High Pressure, 2500-3000 psi capacities from 1 to 53 gpm: Low Pressure, 1000-1500 psi, capacities from 1 to 66 gpm and up.

440 LIGHT-METAL CASTINGS

Thompson Products, Inc., Light Metals Div.—An 8-page booklet, "Creative Castings for Industry," describes Thompson's light-metal casting facilities and includes photographs of typical parts. Stages of casting, from delivery of ingots to delivery of finished parts, are illustrated.

441 ALLOY-STEEL SCREWS

Strong, Carlisle & Hammond Co.—Catalog No. 50 describes the Mac-it line of alloy-steel screws. 26 of the catalog's 36 pages contain technical information on the screws and screw products. Hexagon-socket screws, including knurled cap screws, flat-head cap screws, button head cap screws, shoulder screws, hollow set-screws, hollow lock-screws, and hollow pipe plugs, and other screw products, such as square-head set screws, tool-post screws, square-head collar cap screws, hexagon-head cap screws, stud bolts, milled studs, slotted headless set screws, slotted fillister-head machine and cap screws, slotted flat-head machine and cap screws, slotted round-head machine and cap screws, mining machine screws, and hexagon socket keys, are covered in the catalog.

Your NEW CATALOGS Guide offers readers of MECHANICAL ENGINEERING an opportunity to secure advertisers' latest industrial literature available. In this issue there are 441 items to make selections from. For convenience an index may be found on pages 41 and 42. Select desired catalogs by number, requests limited to 25 catalogs. Fill in coupon on page 42 and mail promptly. (*Must be mailed on or before date given on coupon.*)

MARK CAN LIDS
...ACCURATELY
...ECONOMICALLY

MODEL SF-100-AE
EMBOSSING FIXTURE

This Fixture code marks all sizes of can lids up to one gallon, with one or more lines of lettering—with easily-changed type. A plastic matrix serves as the female die, which can be reused and does not have to be changed as characters are changed. Investigate today!

Write for Complete Data!

Mecco SAFETY MARKING TOOLS
M.E.CUNNINGHAM CO.
1473 N. AVENUE, PITTSBURGH 33, PA.

new SPRAY NOZZLE REFERENCE MANUAL

write for your free copy today

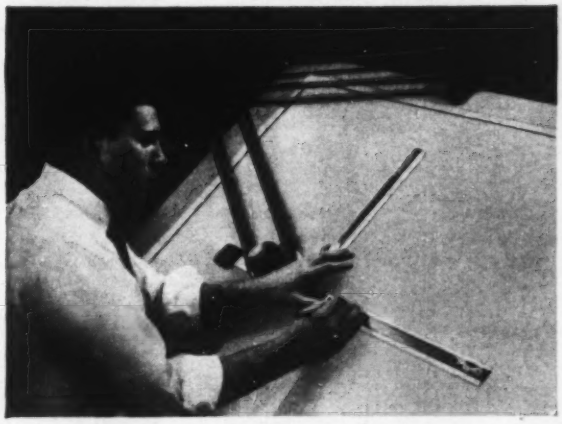
SPRAYING SYSTEMS

- to help you improve a spraying operation
- to help you lower a spraying cost

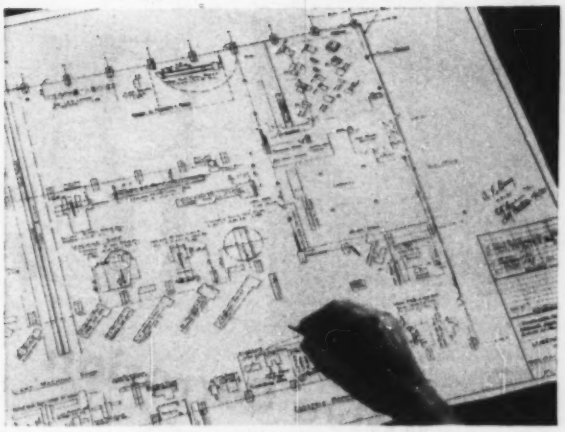
The most complete industrial spray nozzle catalog ever produced. Gives you reference data on thousands of standard and special spray nozzles for every type of spraying.

WRITE FOR your free copy of Catalog No. 24

SPRAYING SYSTEMS CO.
3265 Randolph St. Bellwood, Illinois



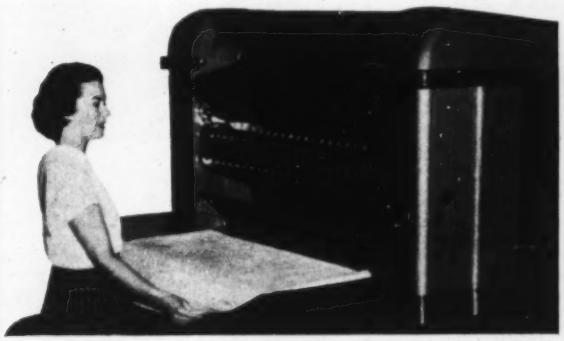
Instead of starting all over again



. . . he begins here

Here's how the Lukens Steel Company, Coatesville, Pa., uses Kodagraph Autopositive Paper to eliminate retracing in preparing flow diagrams and piping layouts.

THESE diagrams and layouts must also show the floor plans and fixed equipment installations of the departments involved. But instead of retracing this information from the basic plant layout drawings, Lukens Steel simply reproduces the drawings on Kodagraph Autopositive Paper—gets *positive, photographic* duplicate tracings directly. This gives the draftsman a tremendous head start . . . for he only has to add the new detail to the Autopositive print . . . *and another job is done instead of being barely begun.*



Low-cost Autopositive reproductions are made this easily at Lukens Steel:

Kodagraph Autopositive Paper is exposed with the drawings in a direct-process machine . . . and processed in standard photographic solutions. A fast, convenient room-light operation that produces positive photographic intermediates *without a negative step . . . without a darkroom.* These intermediates, in turn, assure highly legible prints.

Lukens Steel Company also uses Autopositive Paper *to produce print-making masters* from vendor blueprints; *to simplify filing,* by combining small-vendor drawings on Autopositive intermediates in the standard Lukens drawing size; *to get low-cost protection* for original drawings which must be sent out of the plant.

Kodagraph Autopositive Paper

"THE BIG NEW PLUS" in engineering drawing reproduction.

----------MAIL COUPON FOR FREE BOOKLET----------

16

EASTMAN KODAK COMPANY
Industrial Photographic Division, Rochester 4, New York

Gentlemen: Please send me a free copy of your illustrated booklet, "Modern Drawing and Document Reproduction."

Get the full story on the sensational line of Kodagraph Materials which you, or your local blueprinter, can process easily, at low cost. Write today for free booklet.

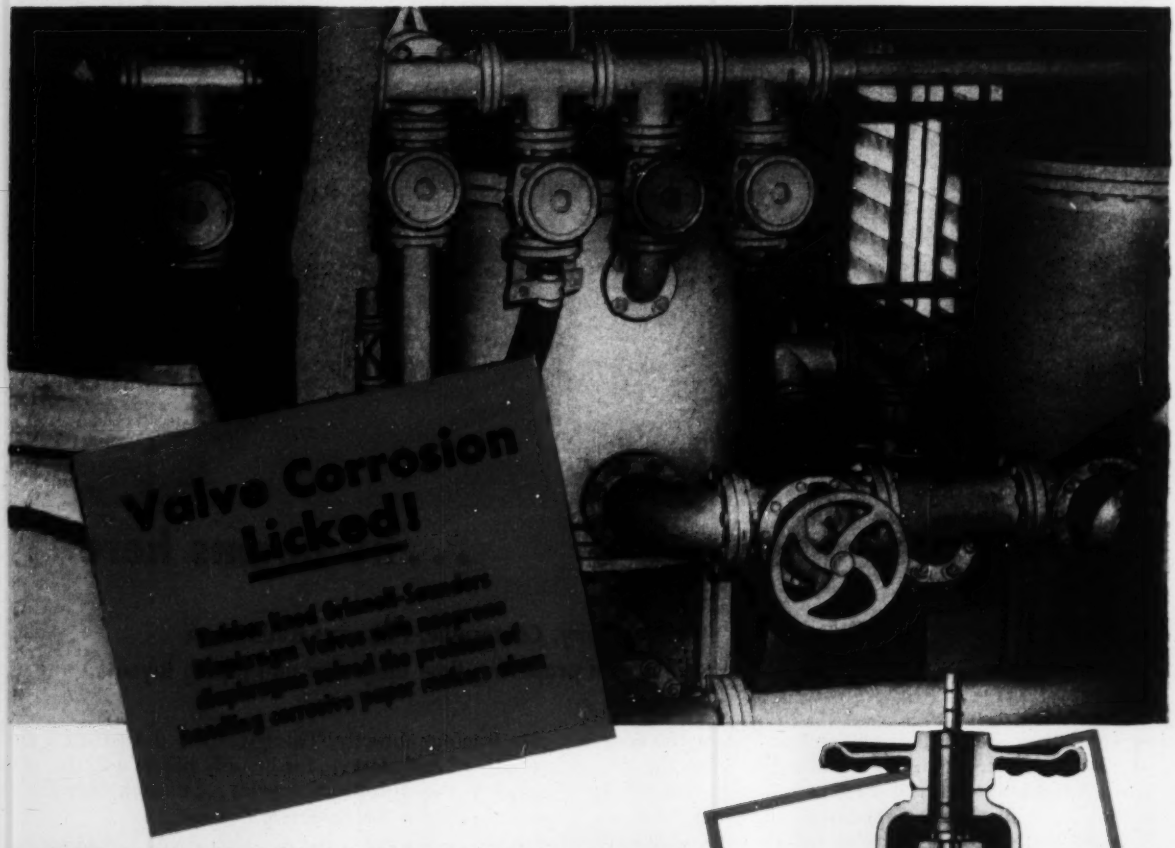
Name_____ Position_____

Company_____

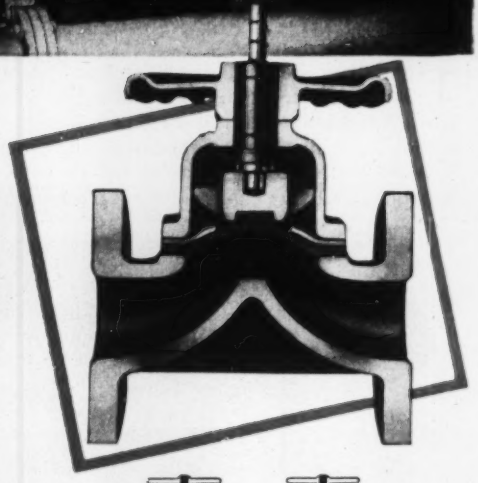
Street_____

City_____ Zone_____ State_____

Kodak



GRINNELL-SAUNDERS DIAPHRAGM VALVES

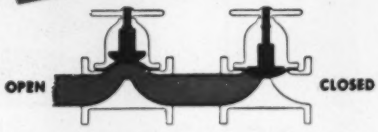


Commercial aluminum sulphate *can be everlastingly troublesome,* as anyone knows who has ever had to work with it. So, comparing notes with a company that handles this chemical every day of its business life may be helpful.

Northern Chemical Industries, Searsport, Me., is an important manufacturer of "paper makers alum". Northern Chemical Industries relies heavily on Grinnell-Saunders Diaphragm Valves. They have found that the wide range of body, lining and diaphragm materials available with Grinnell-Saunders valves offers flexibility in handling a wide variety of corrosive fluids.

The basic design of the valve is an advantage. Working parts are completely isolated from the fluid stream which, in the case of corrosive acids, means longer valve life. Also, there is the matter of economy. With Grinnell-Saunders Diaphragm Valves, it is usually possible to go to less expensive body materials, to which special body linings can be added. Replacement and maintenance expenses, moreover, are greatly reduced.

Originally designed and ideally suited for air and water service, Grinnell-Saunders Diaphragm Valves also are recommended for almost every regular or special service. This is backed up by the excellent performance records achieved by valves now in use.



Features of Grinnell-Saunders Diaphragm Valve:

- Diaphragm absolutely isolates working parts from fluid
- Diaphragm lifts high for streamline flow in either direction
- Diaphragm presses tight for positive closure
- Body, lining and diaphragm materials to suit service
- Simple maintenance — diaphragm easily replaced without removing valve from line

GRINNELL
WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

"Every Nozzle of this type produced by us is tested with the G-R Strobotac and Strobolux"

American Bosch Corporation of Springfield, Massachusetts, leading producer of Diesel fuel injection equipment, uses the G-R STROBOTAC* and STROBOLUX* for 100% inspection of their pintle-type injection nozzles.

They say: — *"For efficient operation, high-speed Diesel engines require not only accurate fuel distribution in each cylinder, but also a nozzle spray which must have a precise pattern during its development in the combustion chamber.*

We use the STROBOTAC and the STROBOLUX to test every nozzle of this type before shipment. Each spray is 'stopped' at various points during its development to evaluate its preinjection, shape, penetration and direction. These spray patterns are checked against master spray charts.

The photograph shows an Inspector checking the spray characteristics of our pintle-type injection nozzle."

One of the Master Spray Pattern Charts against which American Bosch Diesel nozzles are inspected at various points during development of the spray pattern.

Photos Courtesy American Bosch Corporation

You may not be a Diesel manufacturer. Possibly you are not even interested in Diesel engines . . . but this experience of another of the thousands of users of G-R stroboscopic equipment may suggest an application to your processes which can assist you in research, design, manufacture and inspection of your product.

Inexpensive, accurate, easy-to-use and portable, these stroboscopes have been of inestimable value and have opened many new fields in the inspection of rapidly moving accessories in mechanical and electro-mechanical design and production.

We have just published a new Stroboscope Bulletin which describes all G-R stroboscopes and suggests many applications for them. We will be glad to send you a copy. Just fill in the coupon below.

* T. M. Reg. U. S. Pat. Off.
Type 631-BL STROBOTAC: $150
Type 648-A STROBOLUX: $225

Since 1915

Manufacturers of Electronic Apparatus for Science and Industry

GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Massachusetts, U.S.A.

90 West Street **NEW YORK 6**
920 S. Michigan Avenue **CHICAGO 5**
1000 N. Seward Street **LOS ANGELES 38**

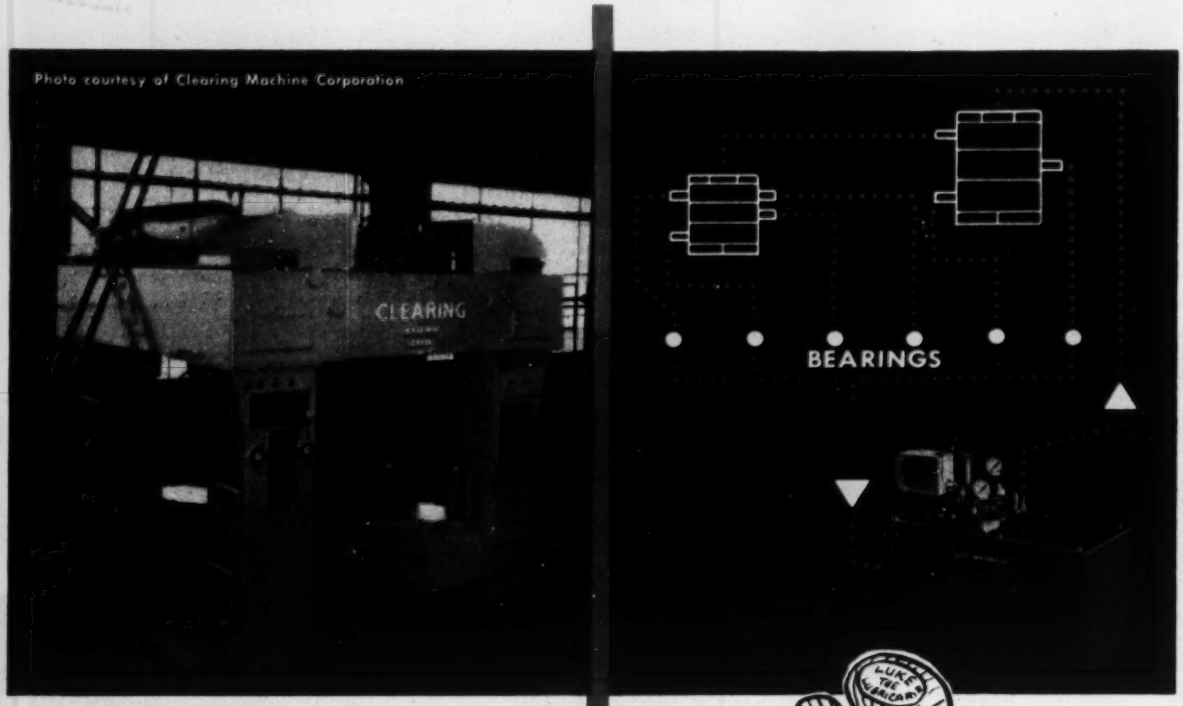
General Radio Company, 275 Massachusetts Ave., Cambridge 39, Mass.
Please send me a copy of the NEW Stroboscope Bulletin.

Name _____
(584)

Company _____

Address _____

Your Title (or Position) _____



Trabon's
METERFLO
OIL CIRCULATING SYSTEM
ELIMINATES TROUBLE

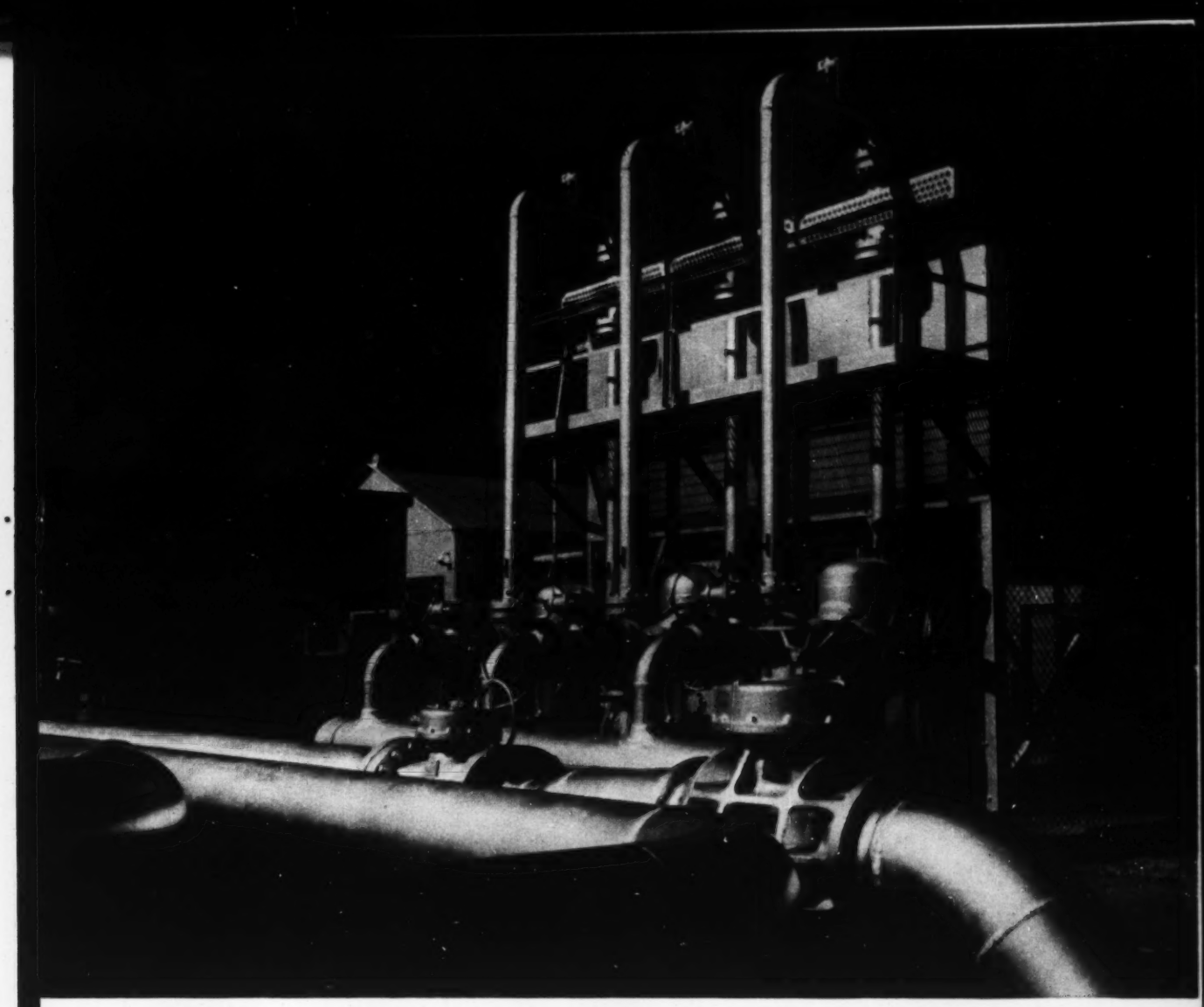
ON 20-TON WELDING PRESS

This is one of an installation of 36 four-point welding presses in a large automotive plant, all automatically lubricated by TRABON METERFLO systems.

TRABON *positive* lubrication assures all of the 68 bearing points on each press the right amount of filtered oil at the right time. Remote indicating gauges are mounted in the left-hand corner column of the presses for easy visibility. Warning lights flash on in the event of interrupted flow of oil to the bearings.

This installation is typical of the thousands of TRABON automatic lubrication systems in operation in industry everywhere . . . under all manner of operating conditions, indoors or outdoors, underground or on the surface.

Trabon ENGINEERING CORPORATION
1814 E. 40th STREET • CLEVELAND 3, OHIO



CONSTANT CONTROL FOR CONTINUOUS PROCESSES

Ever notice how many Rockwell-Nordstrom valves you see at key points in continuous operation processes—where failure of one valve can shut down an entire plant? There's a sound reason for that: Nordstrom valves have a reputation for *not* failing.

If it's wise to use Nordstrom valves in *tough* spots—in lines that must operate 24 hours a day, 365 days a year, year in, year out—doesn't it stand to reason they'll give better service in almost *any* spot?

Nordstrom's first costs are comparable to other valves. In the long run, they're invariably the best buy. There's no substitute for Rockwell experience. Use it to save money on valves. *Rockwell Manufacturing Company, Pittsburgh 8, Pa.*

THREE WAYS
THE NORDSTROM LUBRICANT WORKS

Lubricant surrounds each valve port with a vapor tight pressurized seal. **Nordstrom valves stay tight.**

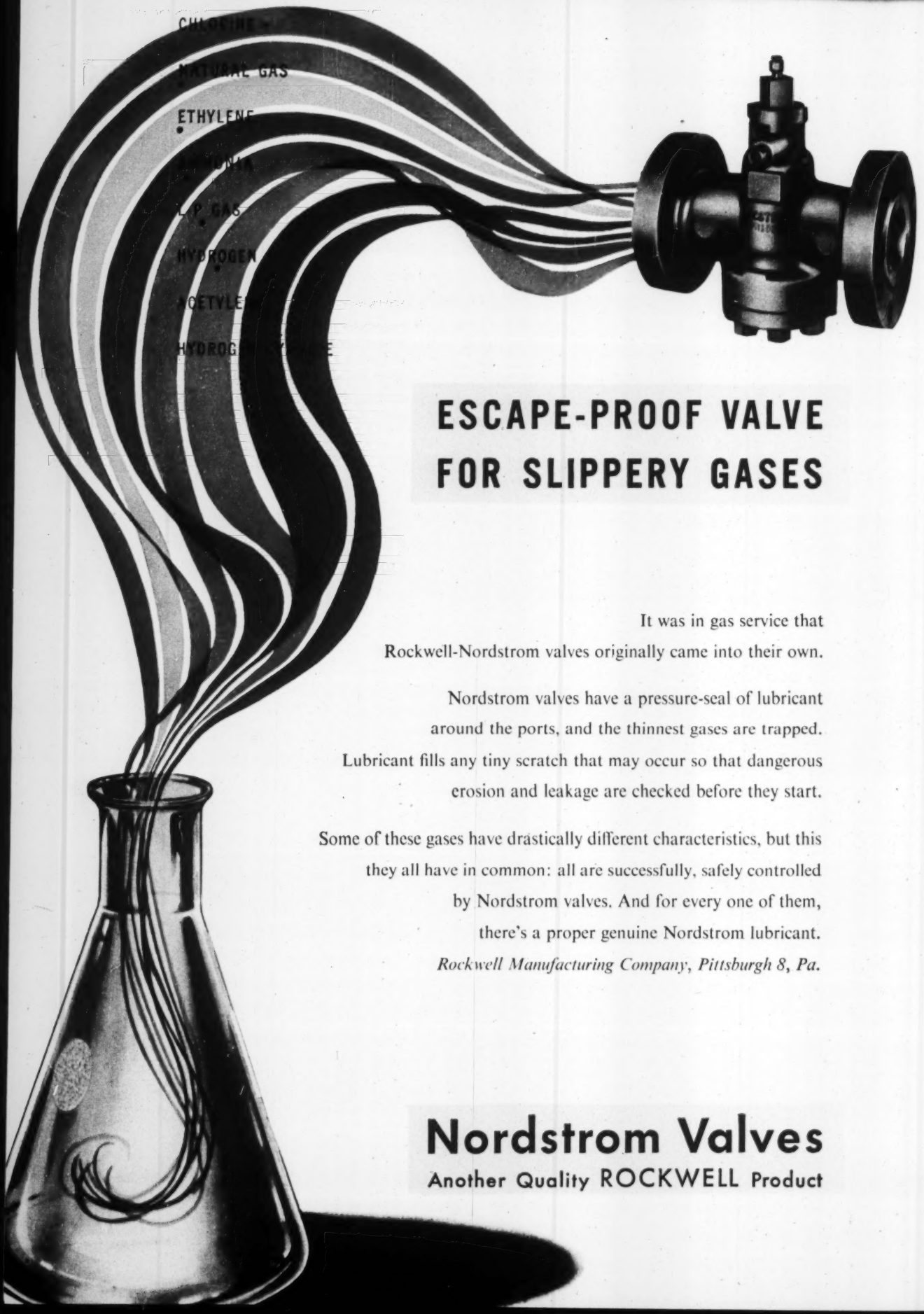
Lubricant acts as hydraulic jack—a fast quarter-turn to open or close. **Nordstrom valves operate quickly.**

Lubricant coats the plug for sliding action—no wear-producing wedging. **Nordstrom valves operate easily.**

Rockwell Built

NORDSTROM VALVES

Lubricant-Sealed for Positive Shut-Off



ESCAPE-PROOF VALVE FOR SLIPPERY GASES

It was in gas service that Rockwell-Nordstrom valves originally came into their own.

Nordstrom valves have a pressure-seal of lubricant around the ports, and the thinnest gases are trapped. Lubricant fills any tiny scratch that may occur so that dangerous erosion and leakage are checked before they start.

Some of these gases have drastically different characteristics, but this they all have in common: all are successfully, safely controlled by Nordstrom valves. And for every one of them, there's a proper genuine Nordstrom lubricant.

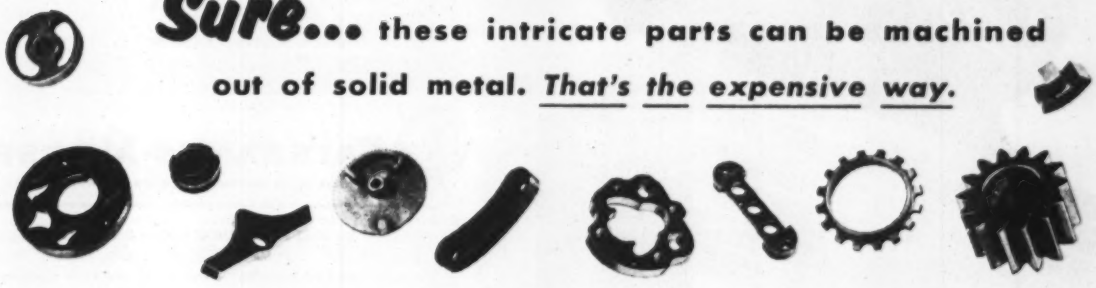
Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Nordstrom Valves

Another Quality ROCKWELL Product

YOU SAVE WHEN YOU USE OILITE FINISHED MACHINE PARTS

Sure... these intricate parts can be machined out of solid metal. *That's the expensive way.*



But... these FINISHED MACHINE PARTS are being made by OILITE *at a Fraction of the Cost.*

Oilite Finished Machine Parts serve the same purpose as conventional "machined" parts. Their performance is just as good, often better, because they can be self-lubricating and made to closer precision tolerances.

Recent achievements by Oilite Research have materially broadened the scope and application of Oilite — Products of Metal Powders.

AMPLEX
DIVISION OF CHRYSLER CORPORATION
Detroit 31, Michigan, Dept. C

6761

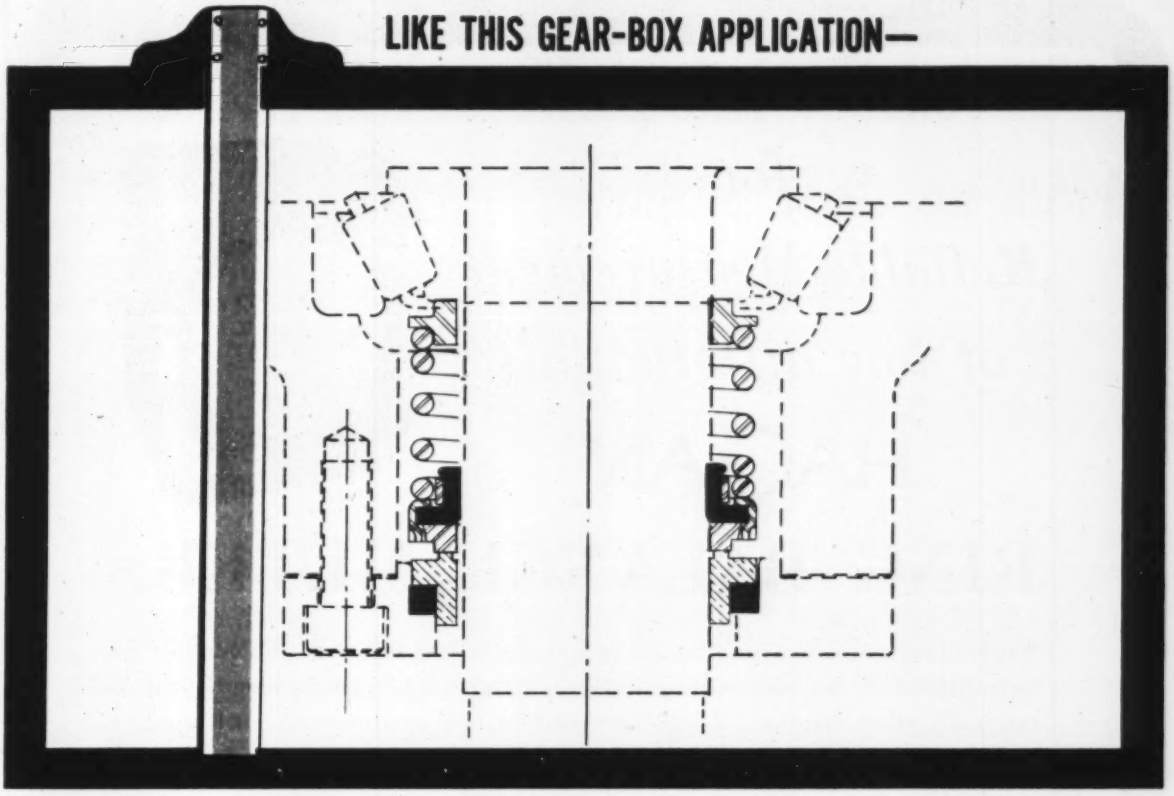
Call an Oilite Engineer. Let him develop your ideas. He will suggest ways and means for decreasing your part costs and show you how to attain other important goals.

FIELD ENGINEERS, DEPOTS AND DEALERS THROUGHOUT UNITED STATES AND CANADA

Oilite Products of Metal Powders Include:
BEARINGS, FINISHED MACHINE PARTS, CORED AND SOLID BARS, PERMANENT FILTERS AND SPECIAL UNITS

...solid foundation
FOR TODAY'S COMPACT MOTOR DESIGN
There are, as you know, new NEMA Standards for electric motors ... more power in less space.
When you look for a new NEMA frame motor, look for the one that is built on a solid foundation ... it carries the Fairbanks-Morse Seal of Quality.
The Standards are new .. But the Idea Is Not
Like the recent Fairbanks-Morse developments in other lines, the new F-M motor is the result of a basic engineering philosophy: More Performance in Less Space—a 120-year tradition at Fairbanks-Morse. Fairbanks, Morse & Co., 600 South Michigan Avenue, Chicago 5, Illinois
FAIRBANKS-MORSE
a name worth remembering when you want the best
ELECTRIC MOTORS AND GENERATORS • DIESEL LOCOMOTIVES AND ENGINES • PUMPS • SCALES • RAIL CARS • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS
MOTIVE DESIGN
NEW MOTOR DESIGN
NEW DIESEL DESIGN
NEW PUMP DESIGN
NEW SCALE DESIGN

LIKE THIS GEAR-BOX APPLICATION—



ROTARY SEALS are *Engineered* to meet specific needs!

Juggling a stock part or assembly to make it fit a specific application is not usually the safe way to get certain, positive sealing. That's why Rotary Seal engineers incorporate the famous Rotary Seal patented sealing principle into a unit "tailor-made" to fit your specific needs, after exhaustive study of all the conditions of manufacturing and use. Such treatment means maximum efficiency, reduction of maintenance and repair expenses, trouble-free performance in use. We'll gladly send you a copy of our booklet describing this Rotary Seal principle, and explaining the advantages.

ROTARY SEALS

Manufacturers in many industries assure the long-run user satisfaction which builds more sales by *Sealing with Certainty* with individually designed Rotary Seals. We believe Rotary Seal engineers can save *you* time and money, too—for best results and greatest economy, call them in at the drawing-board stage of your project!

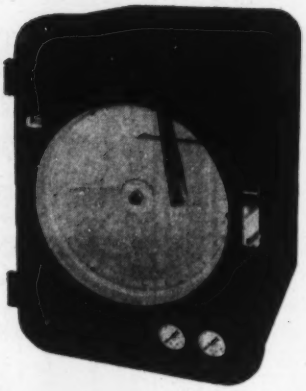
Shaft-Sealing with Certainty

THE mechanical seals for ROTARY SEAL COMPANY rotating shafts

2024 NORTH LARRABEE STREET
CHICAGO 14, ILLINOIS, U.S.A.

for

Reliable Measurement of low differentials



HAGAN

RING BALANCE METERS

Where flow measurements *must* be made with a low full scale differential, the logical choice is the Hagan Ring Balance Meter. This versatile meter, with no external sealing chambers, is equally useful for flow measurements at low differential or high differential, at high or low pressures.

Consider these advantages of the Hagan Ring Balance Meter

Interchangeable sensing elements, in a complete series, are available for measuring full scale differentials from 1″ to 420″ WC, at static pressure up to 3,000 psig.

The ring assembly is selected for each installation to assure ample power for accurate meter operation at all flows.

The differential range of any ring is adjustable over a 7 to 1 ratio.

The level of sealing fluid in the ring is not critical, the only requirement being sufficient depth to seal against maximum differential.

Calibration, using dead weights, takes only a few minutes. It is not necessary to disconnect the meter from the line.

Automatic compensation for such variables as temperature, pressure or fluid density is a standard attachment.

Pneumatic or electric signal transmission is available for remote recording or automatic control.

The Hagan Ring Balance Meter is the most versatile design available for flow measurements with any source of differential—orifice plate, venturi tube, pitot tube, weir or flume.

We will be glad to suggest the metering equipment best suited for improving existing facilities, or for extensions and new construction.

HAGAN
HALL
BUROMIN
CALGON

HAGAN CORPORATION

Hagan Building • Pittsburgh 30, Pennsylvania

Boiler Combustion Control Systems • Ring Balance Flow and Pressure Instruments • Metallurgical Furnace Control Systems Control Systems for Automotive and Aeronautical Testing Facilities

Hotpoint checks hermetic seals on moving production line

Consolidated Leak Detector

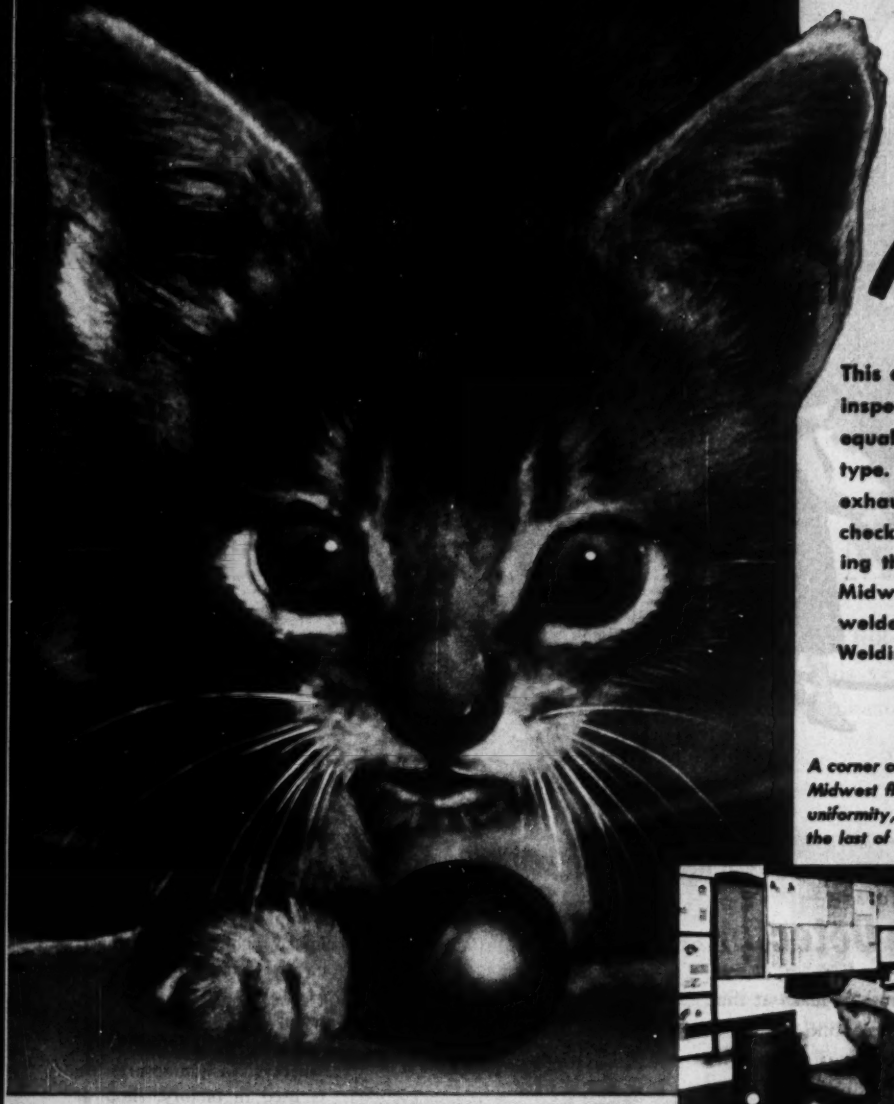
Checking refrigeration systems for leaks at the rate of 100 units per hour is a routine Hotpoint production line procedure. The units are evacuated to approximately 50 microns, sealed and passed under a helium hood. Any leak, even in the micron range, draws a mixture of helium and air into the system. Still moving, the evacuated units are checked with a Consolidated mass spectrometer-type leak detector. The slightest trace of helium sounds an audible alarm and the faulty unit is pulled off the line. These mobile, highly sensitive leak detectors are adaptable to a wide range of operations for production line control of both vacuum and pressure systems.

Completely portable in its light weight, castor equipped cabinet the Consolidated Model 24-101A Leak Detector is an accurate, practical tool for locating leaks wherever vacuum or pressure is used in factory, shop or laboratory. Write for Bulletin CEC-1801B —X18.

Consolidated Engineering
CORPORATION
300 North Sierra Madre Villa, Pasadena 15, California

Sales and Service through **CEC INSTRUMENTS, INC.,** *a subsidiary with offices in: Pasadena, New York, Chicago, Washington, D. C., Philadelphia, Dallas.*

ANALYTICAL INSTRUMENTS FOR SCIENCE AND INDUSTRY



Close Inspection

This cat picture makes us think of the final inspection of Midwest Welding Fittings. It is equally intense, searching, eye-on-the-ball type. Such final inspection is only one of an exhaustive series of continuous controls and checks that play an important part in assuring the high quality and uniformity of all Midwest Welding Fittings. You can cut your welded piping costs by specifying Midwest Welding Fittings.

A corner of the Final Inspection Department where every Midwest fitting is individually checked for concentricity, uniformity, and dimensional accuracy. Such checks are the last of a series conducted during production.

MIDWEST PIPING COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Pascola, Los Angeles and Boston

Sales Offices: New York 7—50 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 33—520 Anderson St. • Houston 2—1213 Capitol Ave.
Tulsa 3—234 Wright Bldg. • Boston 27—436 First St.

STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

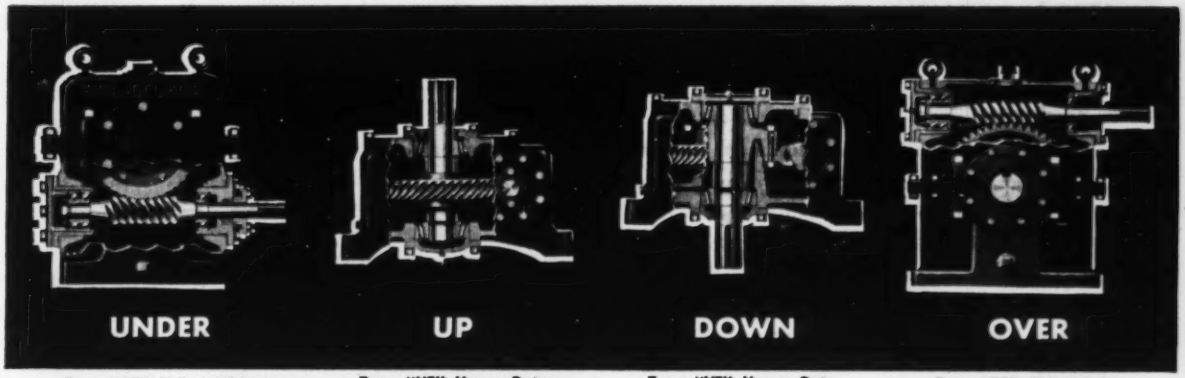
MIDWEST WELDING FITTINGS

61

Midwest Welding Fittings Improve Piping Design and Reduce Costs

for any size and type of WORM REDUCER

specify PHILADELPHIA ...and be safe



Type "AT" Philadelphia Heavy Duty Worm Gear Reducer, with worm shaft below the worm gear.

Type "UT" Heavy Duty, Vertical Worm Gear Reducer, with slow speed shaft extended upward.

Type "VT" Heavy Duty, Vertical Worm Gear Reducer, with slow speed shaft extending downward. (Note "dry-well" construction around downward shaft.)

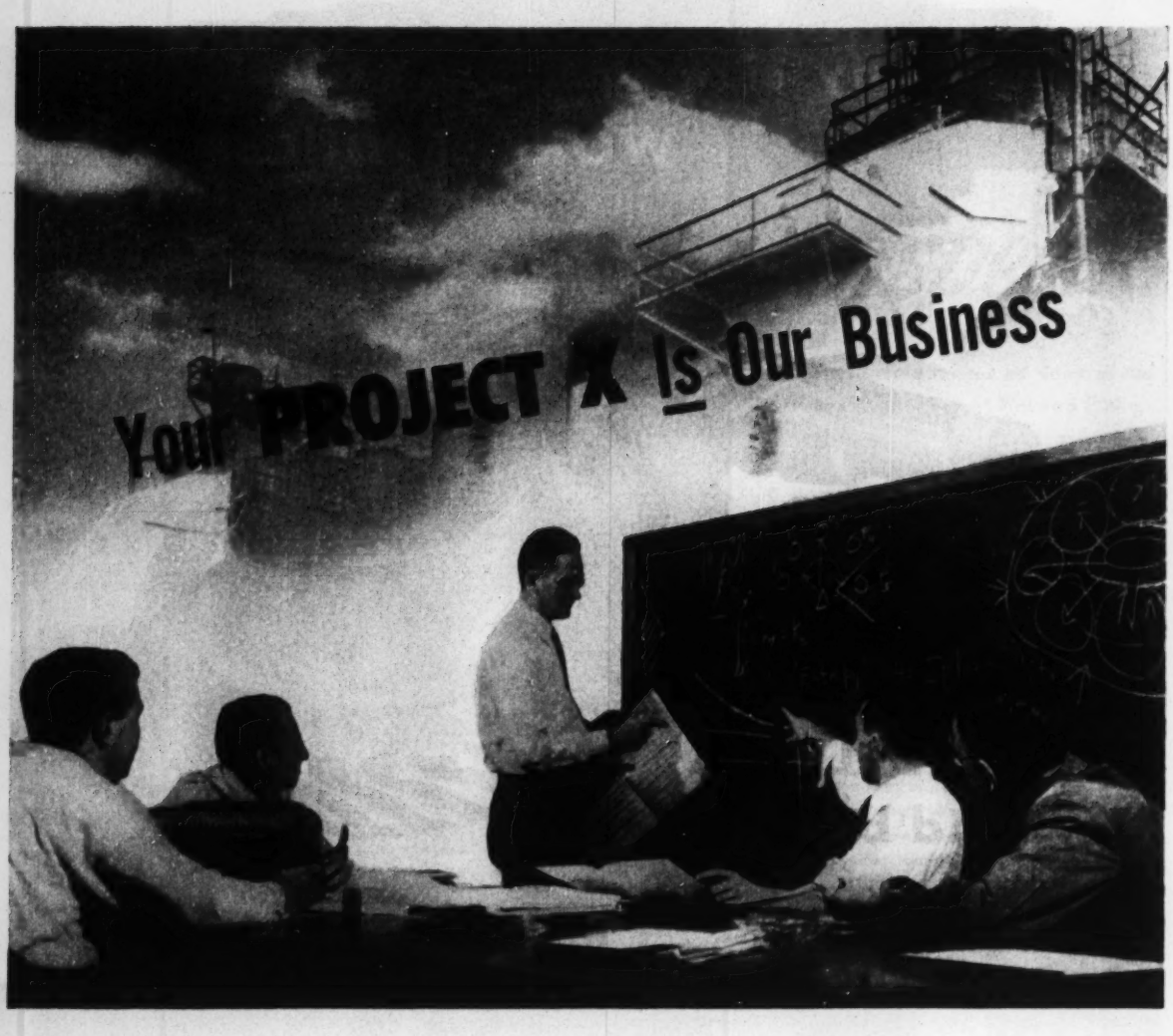
Type "RT" Philadelphia Heavy Duty Worm Gear Reducer, with worm shaft above the worm gear

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears & Speed Reducers

Limitorque Valve Controls



Creation and development of mechanical equipment are major items in any Project X in any technological field. Either is a matter of professional knowledge, personal treatment, facilities, and time. With enough of all these factors, any research and development department can solve its own problems. When they're in short supply, it must turn to outside help.

Our Mechanical Division offers that help. Here is concentrated a greater diversity of specialized personnel and facilities than a single company can normally focus on a research or development project. Here, scientists blend their knowledge and talents with the industrial research experience of engineers and other technologists. This teamwork has a proven record of performance.

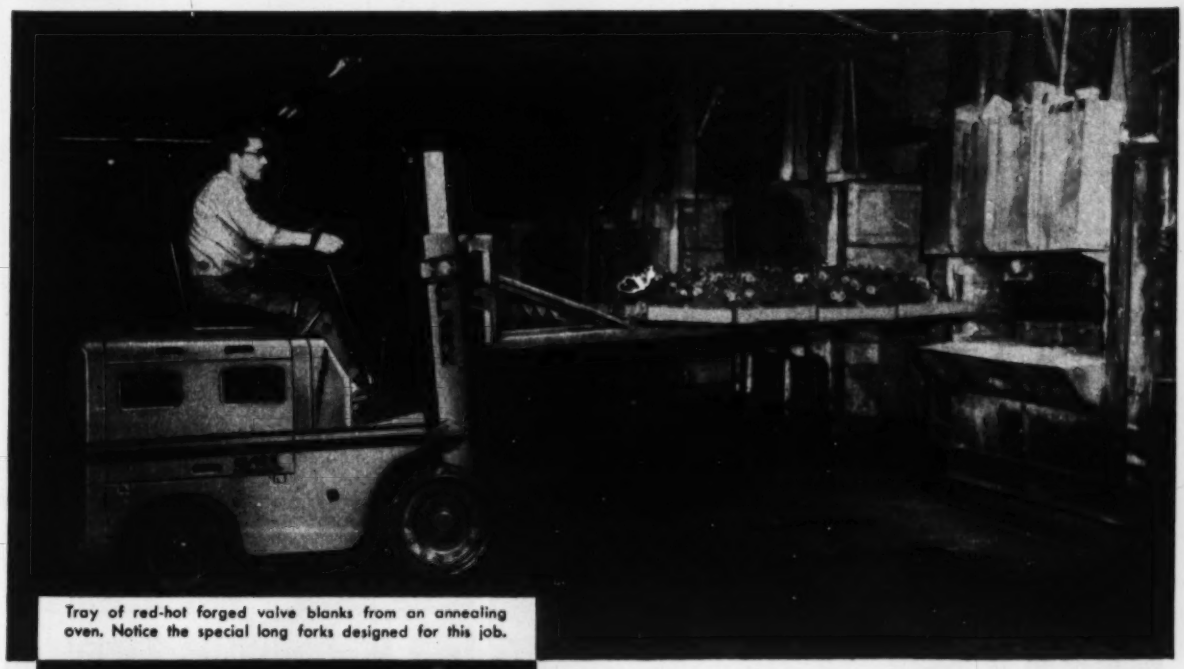
If you have a Project X which calls for outside help, the Mechanical Division of Arthur D. Little, Inc. is available to cooperate on one or more of the following bases:

1. Basic research
2. Complete development after basic research
3. Refinement of existing equipment
4. Prototype construction
5. Construction of complete process equipment

For further information or preliminary discussions, phone UNiversity 4-9370 (Boston) or write to:

Arthur D. Little, Inc.

Mechanical Division
30 MEMORIAL DRIVE, CAMBRIDGE 42, MASS.
Creative Technology Since 1886



Tray of red-hot forged valve blanks from an annealing oven. Notice the special long forks designed for this job.

Weighing load of slugs to determine number of pieces produced. Tote boxes have weight marked on side.

Double duty: the tireless Clark handles a palletized load for shipment, tows trailer-loads of scrap.

Storing and handling of coolant and lubricants ceased to be a problem when the Clark took over.

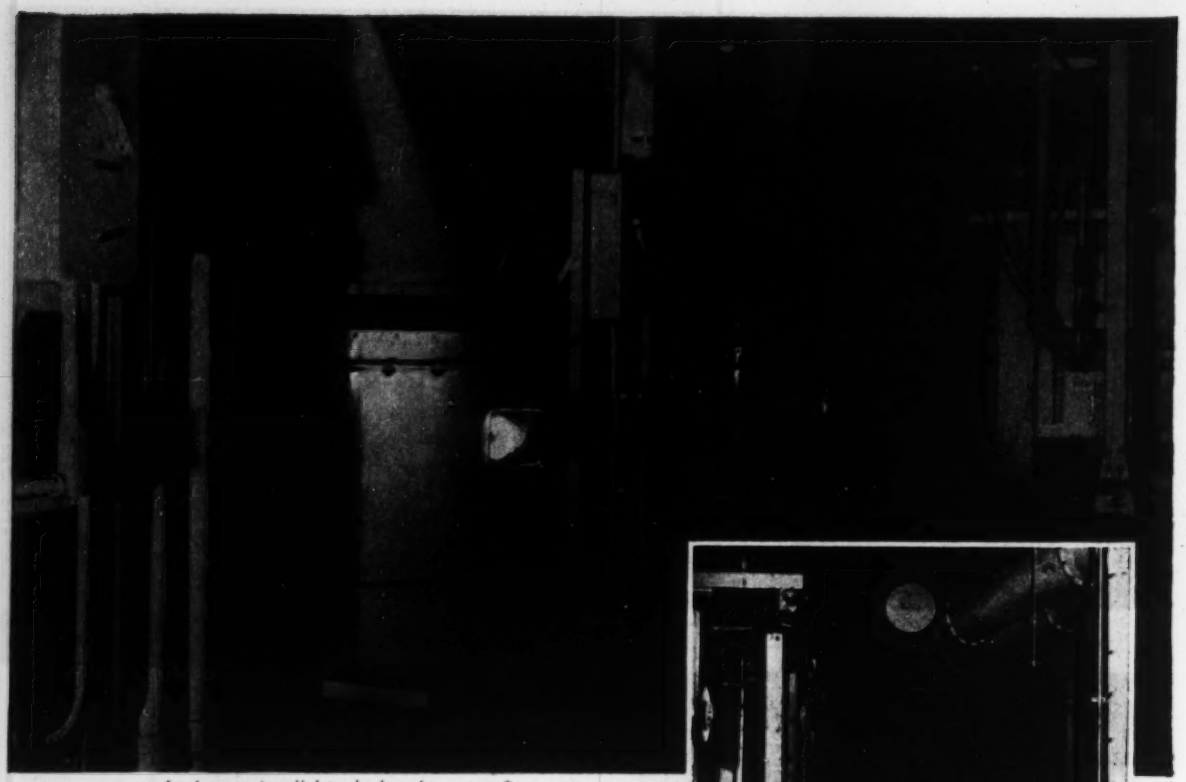
From rough slugs for forging to palletized loads for shipment— EATON VALVES are CLARK-handled

"Our Clarks do more jobs than any equipment in the plant," say production men of the Eaton Valve Division. 750,000 motor valves per week—different sizes, shapes, material and finishes—must be handled on schedules carefully synchronized for uninterrupted production. Eaton depends on its 4000 lb. Clark electrics to do the job smoothly, efficiently. In addition, they utilize their Clark trucks to handle drums of lubricants and coolants, haul scrap, do plant-maintenance work. They cut handling costs *throughout* the plant—not merely on the production line.

The wise way to find out where and how your own handling costs can be cut is to talk it over with your Clark dealer. He's listed in the Yellow Pages—call him now.

CLARK EQUIPMENT

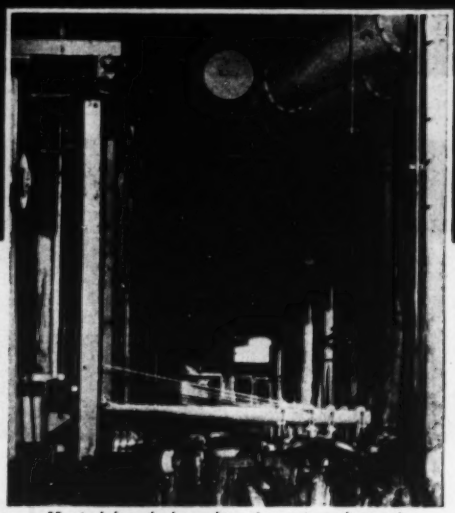
Industrial Truck Division
CLARK EQUIPMENT COMPANY
Battle Creek 88, Michigan



Joy fans are installed in the ducts for greater efficiency, easier installation, and economy of floor space.

PLATING LINE VENTED BY JOY AXIVANE® FANS

Corrosive Air Removed in Jig-time By "In-the-Duct" Installation of Exhaust Fans



Vertical branch ducts draw fumes into the trunk line for ultimate discharge into the atmosphere.

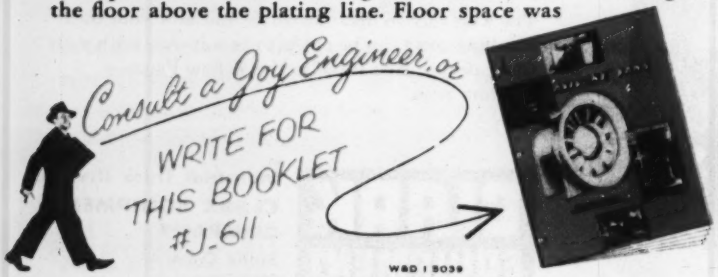
An interesting, and necessary, feature of the new zinc and cadmium plating line at Appleton Electric Company, Chicago, is the compactness of the Joy Axivane Fan exhaust system.

This exhaust system carries off the hot, corrosive air from the plating line up to the roof where it is discharged into the atmosphere.

Centrifugal units would have necessitated an expensive modification in the building structure, in addition to a larger, more complicated duct system.

The compact, in-line design of the Joy Axivane Fans permitted installation *right in the ducts* on the floor above the plating line. Floor space was saved, installation costs were drastically reduced, building structure did not have to be altered, and a much smaller and simpler duct system was constructed!

Joy Axivane Fans will show you new standards in efficiency, compactness, quietness, and outstanding versatility. There are 136 models . . . all with adjustable blades . . . for volumes up to 300,000 CFM and pressures to 11″ wg. Get the full story on Joy Fans by writing for Bulletin J-611, TODAY. ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

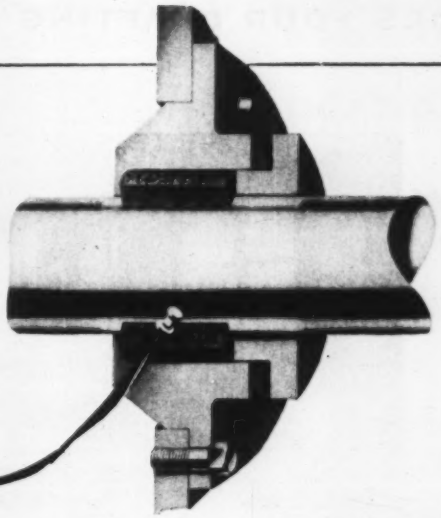


JOY

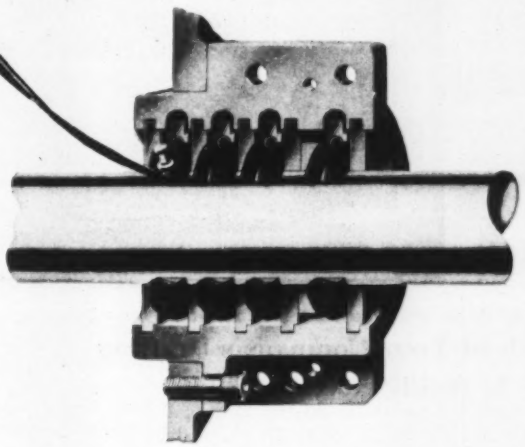
SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885

COPPUS TURBINES

offer you a choice of packing rings



STANDARD METALLIC RING PACKING — Made of high grade asbestos cores encased in specially treated lubricated aluminum foil. Recommended as a low-friction, long-service packing for steam temperatures up to 850 F and back pressures up to 50 lb. Adjustable packing glands keep leakage at minimum. Easy access to packing rings.



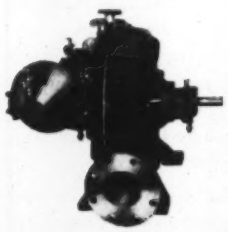
OPTIONAL CARBON RING PACKING — Consists of three carbon packing rings on the pressure side and one beyond the leak-off section. Each ring has three segments held together by a stainless steel garter spring. For back pressures up to 75 lb. Standard for vacuum or gas operation, or when leak-off is desired.

Heavy chrome plating on shaft at stuffing box is common to both types of Coppus packing.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

FIT TURBINE COSTS TO HORSEPOWER NEEDS

When you buy turbines rated close to your exact horsepower needs, you save plenty of money. That's because turbines are generally priced in proportion to their size. The wide range of sizes of Coppus Turbines promises purchasing economy for you from the 150 hp size down to the smallest. As for operating and maintenance economies, you get them, too, from such other features as: greater number of manually operated valves for individual control of steam nozzles; replaceable cartridge-type bearing housings and others. For complete details . . .



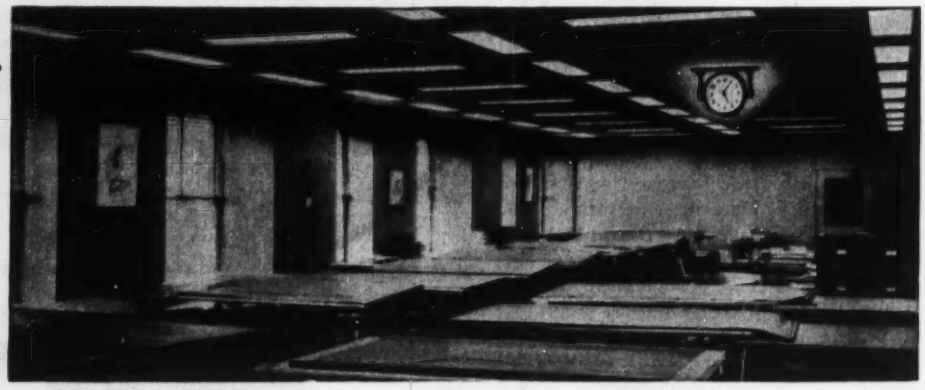
WRITE FOR BULLETIN 135
COPPUS ENGINEERING CORPORATION
364 Park Avenue
Worcester 2, Mass.
Sales offices in THOMAS' REGISTER

COPPUS "BLUE RIBBON" TURBINES

HOW DOES YOUR DRAFTING ROOM LOOK AT 5:05 P.M.?

LIKE THIS...

OR THIS...



How Much of Your Company's Drafting Overtime Is Really Necessary?

Unless your drafting room is constantly plagued by last-minute jobs, the chances are that over 50% of your drafting overtime is really unnecessary . . . because much of the work requiring overtime can be done with ease by photocopy.

Many companies, even those with small drafting rooms, save hundreds of drafting hours each week by using modern photocopy techniques. And these dramatic labor savings can be achieved without additional capital investment! Successful photocopy depends on gearing the machines, materials and methods to the company's specific needs. This job calls for expert photocopy counsel . . . a unique service of Peerless factory distributors.

A Peerless factory distributor can discuss your photocopy requirements in management terms. His years of experience in the field can be of great value to your company. He is skilled in operator training and the newest labor-saving techniques. His professional skill coupled with the products he sells can pay handsome dividends in drafting room efficiency. Why not let him consult with you and your staff? For fast service write us direct.

The entire Peerless line of photocopy papers and machines is sold only through this network of photocopy specialists. Peerless is one major manufacturer in the field whose production and development facilities are devoted exclusively to industrial, scientific and commercial photoreproduction. Complete literature is yours for the asking.

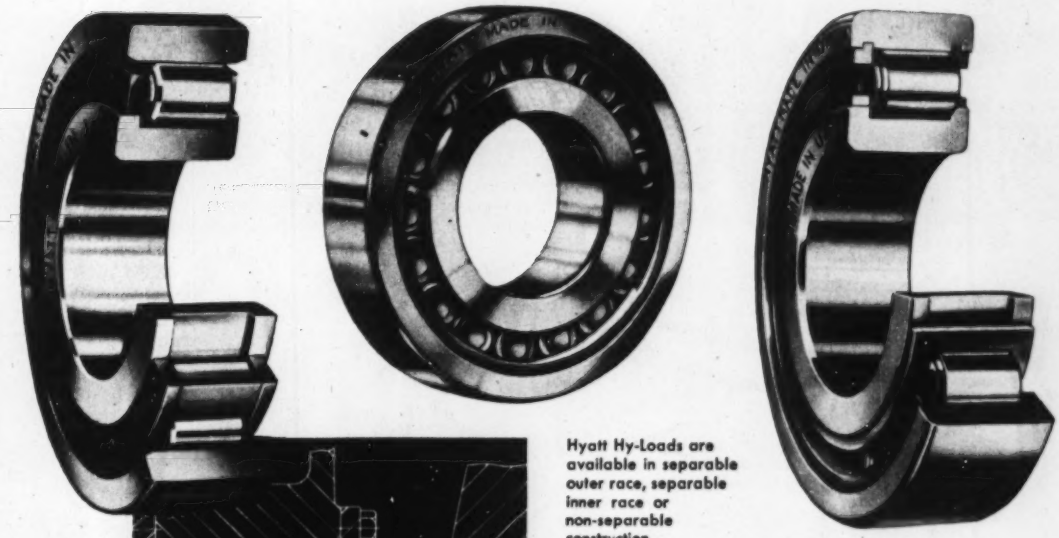
PEERLESS PHOTO PRODUCTS, INC.

Shoreham, Long Island, N. Y.

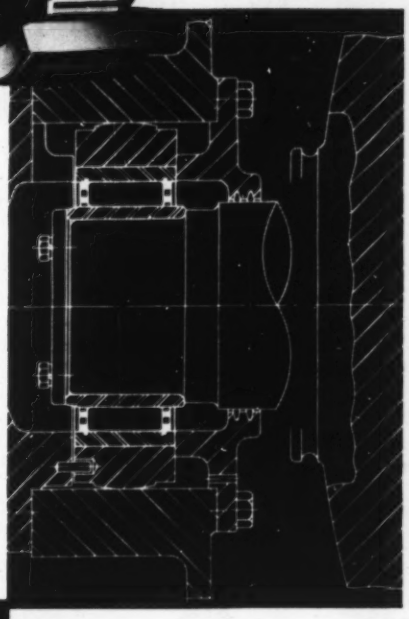
Manufacturers of Quality Photocopy Papers and Special-purpose Industrial Photocopy Equipment

HERE'S HOW HYATTS HELP...

Is shaft expansion a problem?



Hyatt Hy-Loads are available in separable outer race, separable inner race or non-separable construction.



Check the drawing at the left. The bearing is a Hyatt Hy-Load, and because the inner race is cylindrical, the shaft it supports is free to move axially—thus allowing for shaft expansion without cramping the bearing or distorting the shaft. Obviously, this is only one of many ways in which Hyatt bearings can be used to reduce costs as they reduce friction, but it's a good example of why so many designers throughout industry keep their Hyatt catalogs within easy reach.

For further details write for Catalog 150 or call your nearest Hyatt representative.

HYATT ROLLER BEARINGS

STRAIGHT | BARREL | TAPER

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, NEW JERSEY

"You see POWELL VALVES everywhere!"

Not surprising when you realize that Powell makes more kinds of valves and has probably solved more valve problems than any other organization in the world. And this has been going on since 1846.

Wherever flow requires dependable control, there's the place for Powell Valves—available through distributors in principal cities. Made ⅛" to 30" and 125 pounds to 2500 pounds W. S. P. Bronze, iron, steel and corrosion resistant alloys. On problems, write direct to The Wm. Powell Company, Cincinnati 22, Ohio.

CONTROLS FOR THE LIFE LINES OF INDUSTRY

Powell Valves

108th year

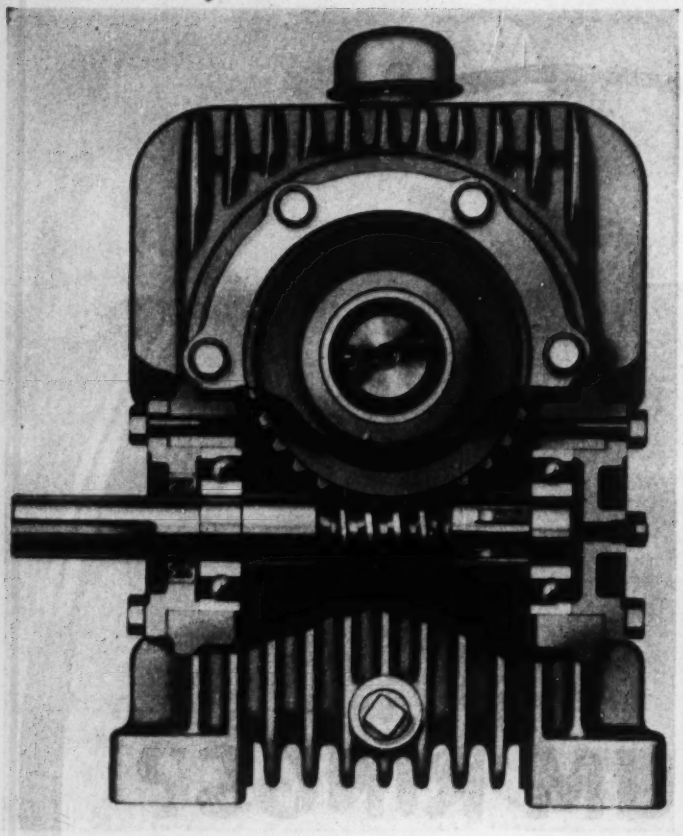
TITANIUM RINGS?

... sure we make them

In 1950 American Welding completed the first successful production flash butt-welding of the new wonder metal — Titanium Alloy. Since that time hundreds of Titanium components have been produced in our plant.

If you use, or are planning to use, fabricated Titanium components, let our Product Development Division study your problem. Our factory is equipped to perform welding, machining, and fabricating of all types of ferrous and non-ferrous metals.
Call or write us today!

THE AMERICAN WELDING & MANUFACTURING COMPANY • 470 DIETZ ROAD WARREN • OHIO



MORE HP PER POUND

•

MORE HP PER CUBIC INCH

•

MORE HP PER DOLLAR

You're looking at the "innards" of the most efficient worm geared speed reducer available today. It's Cone-Drive Gear's exclusive double-enveloping worm gear design, which means more load-carrying capacity, size for size, than any other type of right-angle speed reducer.

This simple design, with the gear and worm literally "wrapped" around each other, means a space and weight savings that often makes the difference between a compact, efficient product and just another machine.

You can specify (from stock) any one of 190,000 standard models of Cone-Drive gears to handle loads from fractional to 800 hp. You can have ratios from 5:1 to 4900:1. Fan-cooled or water-cooled models available if you should need them.

Interested? Get complete details in Bulletin 8901-50.

CONE-DRIVE GEARS

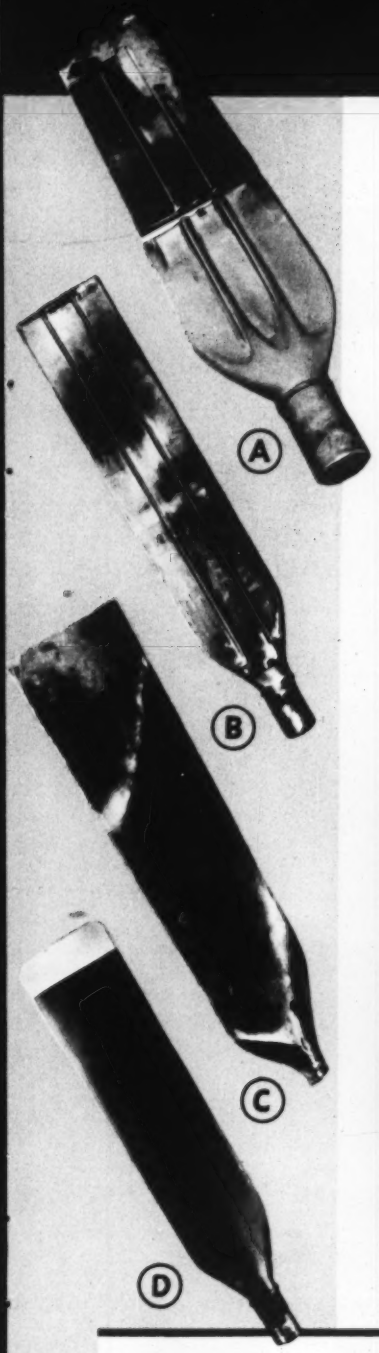
Division, Michigan Tool Company

DOUBLE ENVELOPING GEAR SETS & SPEED REDUCERS

7171 E. McNichols Road • Detroit 12, Michigan

New facts for your file on

USS CARILLOY STEELS



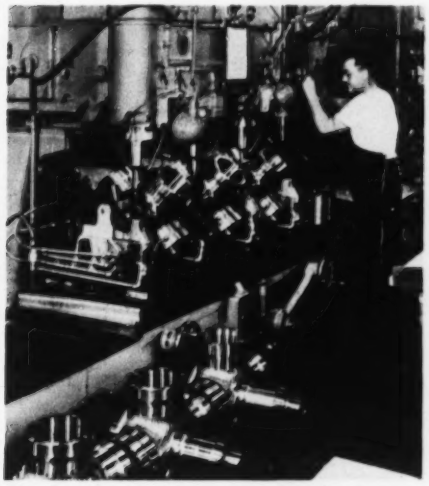
USS Carilloy steel passes rigid tests for propeller blades

● An important manufacturer of propellers for military aircraft has found that in stringent magnaflux tests, USS CARILLOY steel performs completely satisfactorily.

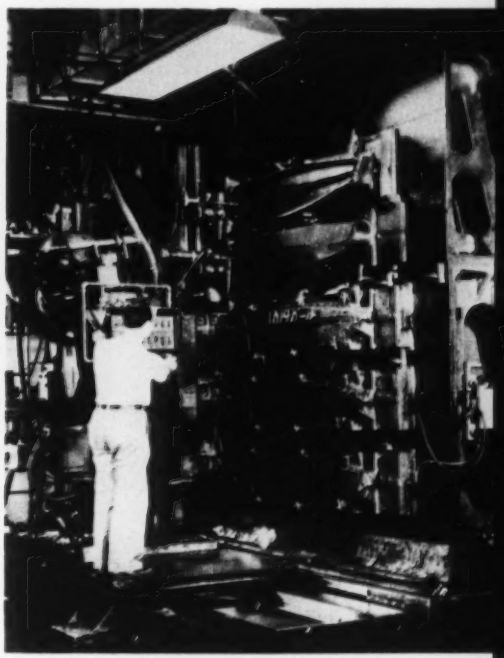
The high stresses in propeller blades and hubs naturally require extremely high quality steels. Accordingly, the U.S. Army and U.S. Navy have set up rigid quality specifications requiring that every heavily stressed part must be magnafluxed several times during its production.

With USS CARILLOY 4340 electric furnace aircraft quality steel, this important manufacturer is able to count on the performance required for this severe application. The consistent high quality of USS CARILLOY aircraft steel has meant greater savings to this customer through minimum magnaflux rejections of costly fabricated parts.

USS CARILLOY steels have established an enviable record for meeting the highest quality requirements. Therefore, when you need a standard AISI analysis or a special steel for an unusual application, it pays to call in a USS Service Metallurgist. He can help you solve any steel problem.



THESE HIGH QUALITY aircraft propeller hubs are forged and machined from semifinished CARILLOY 4340. They meet extremely tough magnaflux requirements.



AFTER FORGING AND MILLING, 750-lb. thrust sections are hogged out on this Kellering machine. Finished sections weigh about 155 lbs. USS CARILLOY steel maintains a No. 1 quality position on these heavy-duty parts.

FOR BIG PROPELLERS, 2 forged sections (a) are welded together to form one blade thrust member. Pieces are then ground and magnafluxed, Kellered, ground, and magnafluxed again (b). Mill camber sheets (c) then are copper brazed to the thrust members. Entire unit is heat treated and polished before final magnaflux test and cadmium plating. Rigorous magnaflux testing assures that every finished blade (d) can withstand the tremendous stresses encountered on the latest high-speed planes.

USS

UNITED STATES STEEL CORPORATION, PITTSBURGH · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST TO COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

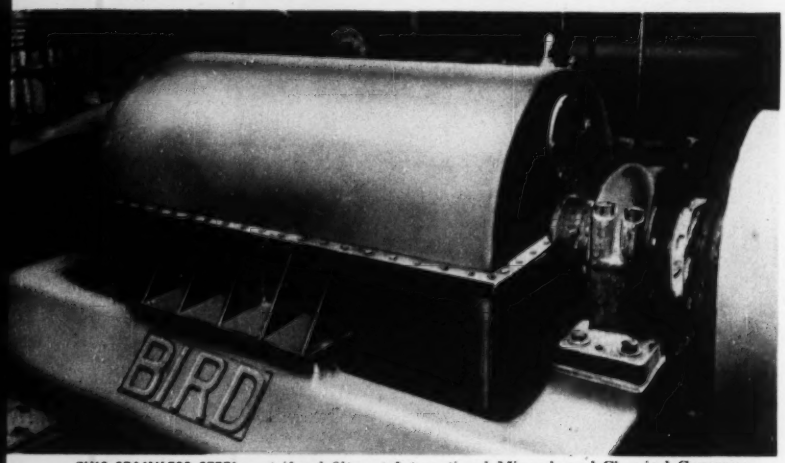
UNITED STATES STEEL

New facts for your file on

USS STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

Solids removed from potash brine in centrifugals of Stainless Steel



THIS STAINLESS STEEL centrifugal filter at International Minerals and Chemical Corporation, Carlsbad, N. M., handles 10 tons of 60% muriate crystals per hour. It was manufactured by Bird Machine Company, South Walpole, Mass.

● Processing potash from the salt beds near Carlsbad, N. M., puts centrifugal filters to a severe test. That's why much of this equipment is made of Stainless Steel.

The potash brine is highly corrosive and the solids to be recovered are very abrasive. As a result, Bird Machine Company, South Walpole, Mass.—which supplies many of the centrifugals for this type of application—uses Stainless Steel for rotating parts and other parts of the filters that come in contact with the material.

Filters built of Stainless have handled many thousands of tons of these materials—separating and dewatering the crystalline solids—with high efficiency and overall economy.

Lake steamer cafeteria is fabricated from Stainless Steel

The attractive appearance, excellent sanitary qualities and long life of Stainless Steel have gained a wide range of food handling jobs for this durable material.

N. Wasserstrom and Sons, Incorporated, Columbus, Ohio, in fabricating cafeteria equipment for a Great Lakes steamer, used Stainless Steel very extensively. The result is an installation that looks well, cleans easily and lasts almost indefinitely.

STAINLESS STEEL was used extensively in this cafeteria installation for a lake steamer. The installation was fabricated by N. Wasserstrom and Sons, Incorporated, Columbus, Ohio.

MANUFACTURED FROM USS STAINLESS STEEL UNITED STATES STEEL

Now is the time to use the sales appeal of Stainless Steel

The many benefits of Stainless Steel make its use in your product a real "plus" from a sales standpoint. Its lasting good looks alone will often justify its use. And, along with this important advantage, goes exceptional resistance to corrosion and abrasion, ease of cleaning and low maintenance costs.

There's never been a better time to take advantage of the qualities of Stainless Steel. And when you do, be sure that perfected, service-tested USS Stainless Steel is used.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

UNITED STATES STEEL

New facts for your file on

USS HIGH STRENGTH STEELS

USS HIGH STRENGTH STEELS — UNITED STATES STEEL — TWENTY YEARS OF PERFORMANCE

USS COR-TEN steel gives heavy-duty earth moving equipment the stamina to stay on the job

● By building maximum strength and durability into parts ordinarily prone to failure, Allis-Chalmers, through the use of USS COR-TEN steel, has ensured a high degree of productivity and profitable performance for their TW-300 Motor Wagon.

Used in the sides, ends and bottoms of the bowl of this big capacity hydraulically operated bottom dump wagon, COR-TEN steel increases strength 50% over carbon steel construction, provides 50% higher fatigue strength, materially increases resistance to abrasion and to sudden blows in loading. An added advantage is increased resistance to atmospheric corrosion—4 to 6 times that of carbon steel.

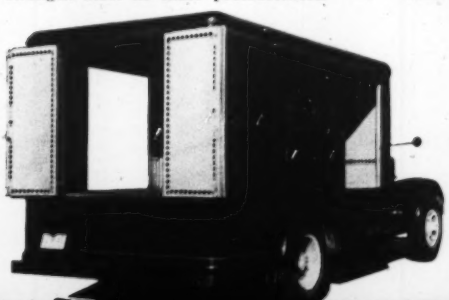
As a result, breakdowns and time-out for repairs are reduced to a minimum, as are maintenance and replacement costs.

In mass-produced truck body members, USS COR-TEN steel saves weight, adds strength, facilitates accurate construction

By mass-producing standardized truck body shapes and sections that can be readily and quickly assembled, Parish Pressed Steel Company, Reading, Pa., has made it possible for local body builders to turn out steel truck bodies to meet individual truck owners' requirements at high speeds and low cost.

The use of USS COR-TEN high strength steel in these prefabricated body sections not only permits light, strong and very durable construction, but because of the high physical properties of this steel and its consistent uniformity, it is possible to hold designs to exact limits and very close tolerances. Over-all results are much better than when less efficient materials are used.

With USS COR-TEN steel construction like this, the body builder benefits because his operations are speeded up and his assembly costs are reduced. The truck owner benefits because he gets a truck that, while light in weight, has maximum strength and durability, is readily repaired if damaged and requires minimum maintenance.



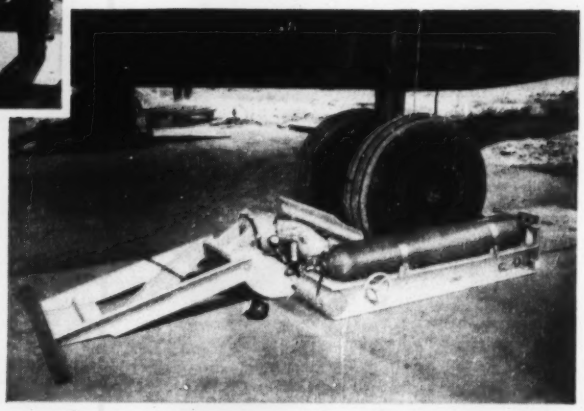
New catalog gives complete story of USS COR-TEN steel

Here are 58 pages of factual data that show the substantial economies that can be affected in equipment and structures by using USS COR-TEN steel to reduce weight or to increase durability and service life. This book is just off the press. Crammed with information, it should be in the reference files of every designer. It fully describes the properties and characteristics of USS COR-TEN steel. Its many illustrations show the wide variety of applications in which this superior high-strength steel has been used to reduce operating costs and to keep maintenance costs at a minimum. Send for your copy.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

UNITED STATES STEEL



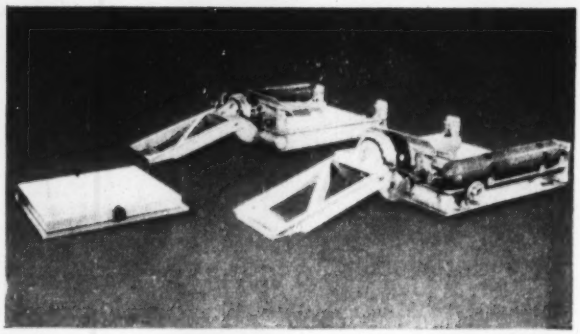
"GO" or "NO GO"

Thrust stands equipped with Hagan ThrusTorq units deliver direct, accurate readings of the actual performance of the plane engines under test. The pneumatic signals actuate indicators or recorders, either at the stand or remote, so that test personnel know instantly whether it is "go" or "no go" for the plane under test.

The portable stand, shown in the center and bottom photographs, requires only stop pieces bolted to the apron. The right and left wheel stands have their own supply of bottled nitrogen, used as a power source for the Hagan ThrusTorq. The stands can be set to suit the span of the landing gear. This stand measures a total thrust up to 25,000 pounds.

Maximum capacity is determined by the number and size of Hagan ThrusTorq units used in the assembly.

The Hagan ThrusTorq unit is fast, economical and clean. It is also used for thrust measurement of rocket and jet engines, and cradle dynamometer measurement of aircraft engines.



Complete Portable Thrust Stand, showing nose wheel unit and thrust measuring units in relative operating positions.

HAGAN
HALL
BUROMIN
CALGON

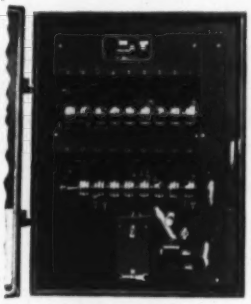
Hagan Corporation

AERONAUTICAL AND SPECIAL PRODUCTS DIVISION
HAGAN BUILDING, PITTSBURGH 30, PA.

CONTROL SYSTEMS FOR AUTOMOTIVE AND AERONAUTICAL TESTING FACILITIES
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
BOILER COMBUSTION CONTROL SYSTEMS

Why Automatic Sequencing of Batch Operations AVE DOLLAR$ . . .

. . . because the Taylor FLEX-O-TIMER® Time Cycle Controller "does its own thinking"—takes care of as many as 36 operations automatically, thus saving operator man hours!



The Taylor Flex-O-Timer Time Cycle Controller

THIS dividend-paying instrument is the Taylor FLEX-O-TIMER Time Cycle Controller. It provides precise, automatic timing of the sequence and duration of up to 36 processing operations involving temperature, pressure, mechanical motion, electrical energy or combinations. There are hundreds of applications throughout industry where this versatile controller can insure greater uniformity of processing, save operator effort — both physical and mental—and save you money. If you say "yes" to any of these questions it will pay you to call in your Taylor Field Engineer now.

Q. Do you have batch processes requiring personnel to perform multiple operations in sequence with complete reliability?

A. The Taylor FLEX-O-TIMER Controller enables you to coordinate batch processes to meet the requirements of a continuous process. You don't have to rely on people to turn the valves or perform other operations at the right time; e.g., the regeneration of a contaminated catalyst bed in a continuous process. The FLEX-O-TIMER Controller will:—stop the process; clean out process fluids; backwash the bed—or burn out the impurities; put the unit back on stream. All this automatically and in accordance with the best practices.

Q. Are you faced with reprocessing and consequent costly waste if certain manual operations do not take place at the right time, in the right sequence and for the correct duration?

A. You eliminate the possibility of human error with this robot brain in control. You can depend on the FLEX-O-TIMER Controller to turn the valve, pull the switch or perform other operations—automatically; e.g., the molding of plastics or vulcanizing of golf balls.

Q. Can customer dissatisfaction ever be traced to variations in product quality due to processing irregularities?

A. Once you've developed the optimum time, temperature, pressure and other variables for a process you can be sure of repeating that process *exactly,* time after time; e.g., backwashing of filter beds in a continuous process. Result: You are assured of a uniformly high quality product—the secret of repeat business.

Q. Wouldn't you consider it a good investment if a completely automatic sequencing control system applied to your batch processes paid off in a year or less?

A. Many chemical plants have increased their profits by revamping their batch processes in this way, using the Taylor FLEX-O-TIMER Controller as the key instrument; e.g., the operation of hydraulic presses in removing excess chemical from fibrous materials; plastic press operation; dry ice molding; the lamination of plywoods; tire molding; the opening and closing of dump valves in paper pulp bleach cells; the batch hydrogenation of edible oils and fats.

Q. Why is this system so successful?

A. Because Taylor Instrument Companies have the necessary experience and know-how to apply instrumentation of this kind to the best advantage in many diversified industries. Taylor Engineers have acquired this skill through many years of working in the field with instrument men and engineers. Their knowledge is at your disposal. Why not write today! Also ask for **Bulletin 98154.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Taylor Instruments
MEAN ACCURACY FIRST

24 ACRES *Cover the World*

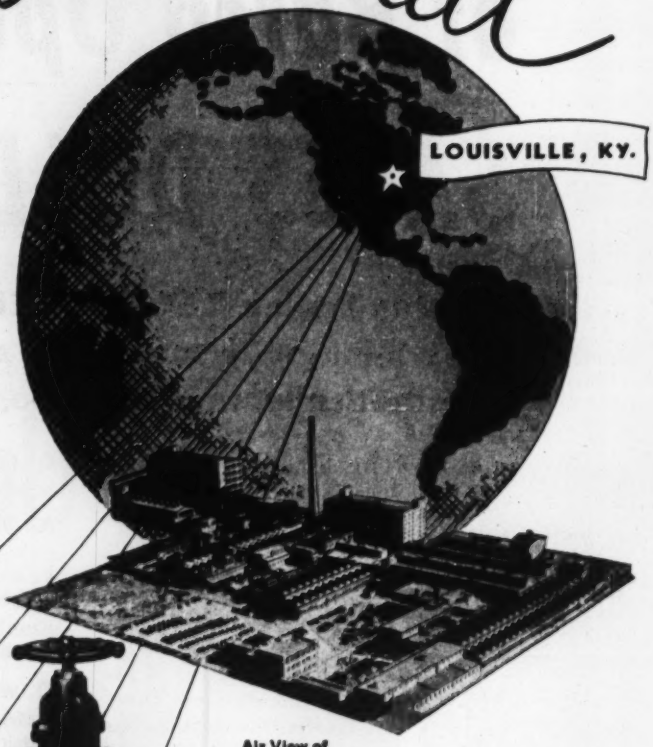
. . . with TOP QUALITY

DROP FORGED STEEL

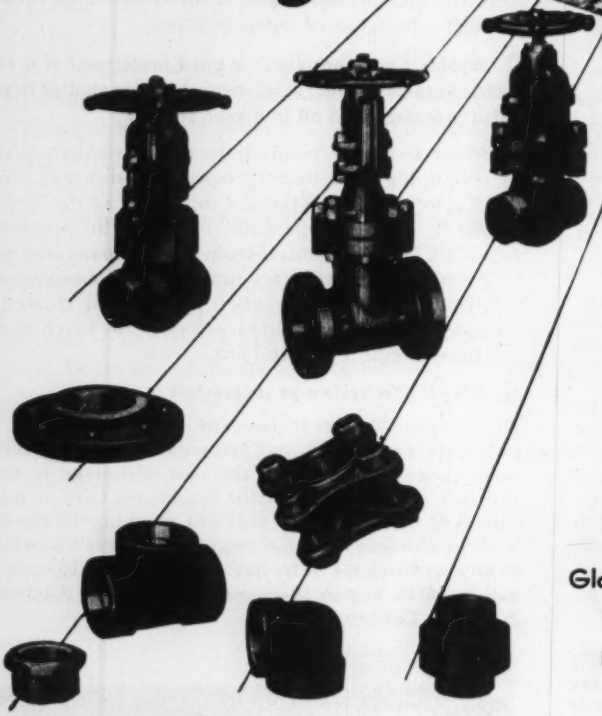
VALVES, FITTINGS and FLANGES

by

Vogt



Air View of
Henry Vogt Machine Co.



This 24 acre Vogt plant supplies the most comprehensive line of top quality *drop forged* steel piping materials anywhere available to industry. That's why they're the choice of leading refineries, power plants, chemical plants, etc., the world around!

OUR COMPLETE LINE INCLUDES

Flanged, Screwed and Socket Weld End Globe, Gate and Check Valves • Ells, Tees and Crosses • Couplings • Bushings • Plugs • Unions • Flanges and Flange Unions • Welding Heads

HENRY VOGT MACHINE CO. LOUISVILLE 10, KY.

Branch Offices: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.

SAVED: $120,000 on refinery fabrication with...

KEY-KAST

ALLOY STEEL WELDING FITTINGS

Substantial Savings for Leading Refinery
PLUS These Other Outstanding KEY-KAST Benefits

1. Delivery of fittings was on *schedule* with the pipe.
2. Quality of the fittings was consistent throughout, with not one rejection.
3. Although KEY-KAST fittings were *not* ordered to radiographic quality—all weld ends were gamma rayed and KEY-KAST fittings showed up better than class 2 per ASTM E-71.

GIVE YOUR PIPING SYSTEM THE ADVANTAGES OF KEY-KAST ALLOY STEEL WELDING FITTINGS

- Greater wall thickness throughout with *extra* thickness in critical areas.
- Lower unit cost.
- Meet A.S.M.E., A.S.T.M., A.S.A. Codes.
- Rigidly tested and inspected to meet high standards of quality.

IN ALL SHAPES, SIZES, SCHEDULES IN LOW AND INTERMEDIATE ALLOYS AND VARIOUS STAINLESS STEELS

Write for information and prices

Key company

Since 1916 . . . manufacturers and developers of products for high temperatures and pressures

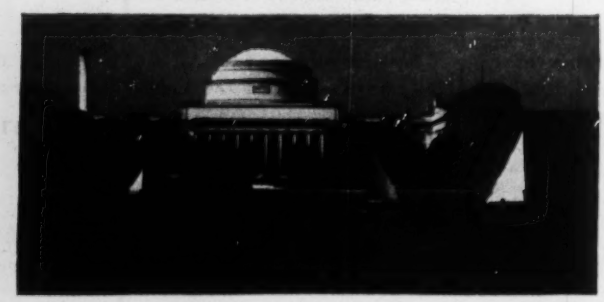
P. O. BOX 494-F, EAST ST. LOUIS, ILLINOIS

DISTRICT OFFICES: NEW YORK • CLEVELAND
CHICAGO • TULSA • HOUSTON • LOS ANGELES

Another M. I. T. Building Equipped

In this Famous Scientific Institute Powers thermostatic control for heating and air conditioning systems is used in the new Dorrance Laboratory for Biology and Food Technology and in the buildings listed below.

- **MAIN EDUCATIONAL AND ADMINISTRATION BUILDINGS**
- **GAS TURBINE LABORATORY**
- **CHEMICAL ENGINEERING BUILDING**
  Architects: Coolidge and Carlson • Contractor: The Downey Co.
- **HAYDEN MEMORIAL LIBRARY**
  Architects and Engineers: Vorhees, Walker, Foley and Smith
  Contractor: Cleghorn Co.
- **NUCLEAR SCIENCE LABORATORY**
  Architects: Anderson & Beckwith • Contractor: The Merrill Co., Inc.
- **SWIMMING POOL BUILDING**
  Architects: Anderson & Beckwith
  Engineers: Wolff & Munier • Contractor: H. E. Whitten Co.
- **NEW AUDITORIUM, now under construction**
  Architects: Eero Saarinen & Associates
  Associate Architects: Anderson & Beckwith
  Engineer: Hyde & Bobbio • Contractor: H. E. Whitten Co.



Other Prominent Users of

UNITED STATES CAPITOL
House and Senate Chambers
UNITED NATIONS
General Assembly
and Conference Buildings
HARVARD UNIVERSITY
Various Prominent Buildings

POWERS CONTROL

Argonne National Laboratory • Abbott Laboratories
Aluminum Co. of America • American Telephone & Tel. Co.
American Optical Co. • Anheuser Busch Co. • Armour & Co.
Bendix Aviation Corp. • Bachman-Uxbridge Worsted Co.
Campbell Soup Company • Celanese Corp. of America
Chrysler Corp. • Ford Motor Co. • General Motors Corp.
Douglas Aircraft Co. • E. I. DuPont de Nemours Co.
Esso Research Center • Eastman Kodak Co.
B. F. Goodrich Tire & Rubber Co. • Humble Oil Co.
Johns Manville Co. • Johnson & Johnson Co.
Lever Brothers Co. • Eli Lilly & Co. • Lily Tulip Cup Corp.
Lahey Clinic • Massachusetts General Hospital
Massachusetts Mutual Life Insurance Co.
Monsanto Chemical Co. • Montgomery Ward & Co.
Parke Davis & Co. • Pepperell Mfg. Co. • Sears Roebuck & Co.
Sharp & Dohme Inc. • Swift & Co. • Thompson Products, Inc.
Wm. Wrigley Co. • Hiram Walker Inc. • Wyman-Gordon Co.
New York Stock Exchange • Radio City Music Hall
Madison Square and Boston Garden • Rockefeller Center

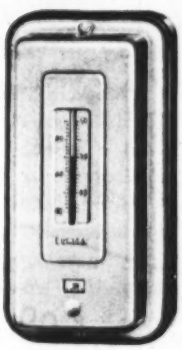
FOR
BIOLOGY and FOOD
TECHNOLOGY

Architects
ANDERSON & BECKWITH

Engineers
CLEVERDON, VARNEY & PIKE

Contractor
JAS. S. CASSEDY, INC.

with a POWERS Pneumatic System of *Temperature Control*



Powers Room Type Thermostat pneumatically regulates heating and air conditioning systems. Outstanding for accuracy and dependability.

Laboratory with an Exciting Future — From this modern laboratory with its excellent staff and research facilities will come great advances that will surpass the progress of the past and produce discoveries which will benefit us all.

Correct room temperature and humidity is important here. Research labs, animal rooms, constant temperature rooms and classrooms require the even, constant temperature assured by a Powers control system.

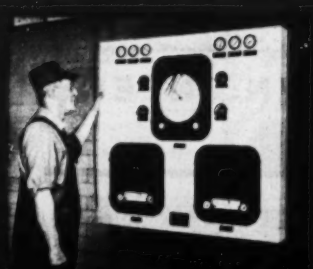
When you want dependable, accurate control for heating, cooling or air conditioning for any building or industrial process call Powers. With over 60 years of experience and efficient modern equipment we can help you select the best control for your requirements.

THE POWERS REGULATOR CO.

OVER 60 YEARS OF AUTOMATIC TEMPERATURE CONTROL

SKOKIE, ILLINOIS • Offices in Over 50 Cities in U. S. A., CANADA and MEXICO

(b46)



POWERS
PACKLESS
VALVES

. . . eliminate packing maintenance, leakage of water or steam, or loss of vacuum.

STUDENT MEMBERS
OF THE ASME

you can get—

A LITTLE CASH!
A LITTLE FUN!
A LITTLE FAME!

HERE'S your opportunity to get that for which you have lacked the wherewithal. There's just one catch — you will have to work for it! If you quit easily — don't read any further. Perhaps a little extra work on your thesis will do the trick.

An engraved certificate signed by the President and Secretary of the Society will accompany each award.

A trip to the Annual Meeting as a guest of the "Old Guard" will be awarded.

Students should consult the Honorary Chairman regarding the rules for these awards. Only papers by single authors will be considered.

Each student must submit his paper to the Vice President of the Region in which his Student Branch is located not later than ***May 15, 1954.***

$150.00

For the best paper by an undergraduate on the subject "The Engineer in Business and Industry." This is the Charles T. Main Award.

An undergraduate must submit his paper for the Charles T. Main Award or Undergraduate Student Award before thirty days after the completion of his undergraduate work.

$25.00

For the best paper on an engineering subject by an undergraduate. This is the Undergraduate Student Award.

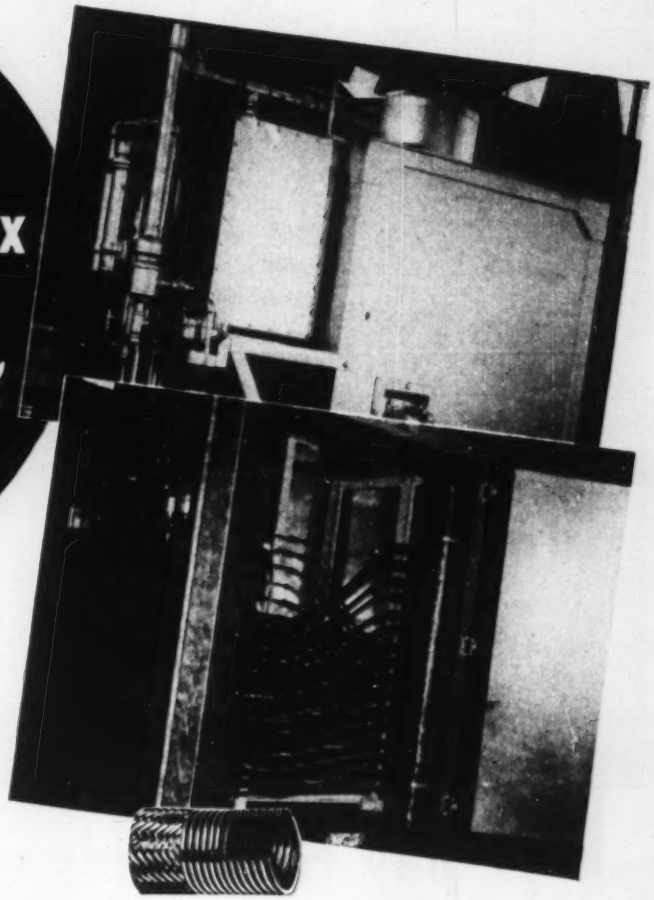
$25.00

For the best paper on an engineering subject by a graduate student. This is the Postgraduate Student Award.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

29 West 39th St., New York 18, N. Y.

NOW
INDUSTRIAL REX-FLEX
Heavy Wall
Stainless Steel
HOSE



Available in four types to meet every design need

TYPE RF-44—Annularly corrugated; sizes from 2½" through 6" I.D. for working pressures to 40 psi.

TYPE RF-45—Same as Type RF-44, but with metal braid covering for working pressures to 410 psi.

TYPE RF-54—Helically corrugated; sizes from ¼" through 2", I.D. for working pressures to 440 psi.

TYPE RF-55—Same as Type RF-54, but with metal braid covering for working pressures to 3100 psi.

To meet the growing demand for heavy duty stainless steel hose, Flexonics Corporation now offers new heavy wall Industrial REX-FLEX. Backed by unmatched experience in the manufacture of corrugated stainless steel, steel and bronze hose, the new Industrial REX-FLEX marks an important step forward in the development of corrosion-resistant hose that can stand the gaff of rugged industrial service, and still maintain maximum flexibility.

A complete range of flanged or screwed fittings may be used, attachment being made by silver brazing or atomic hydrogen welding.

Write for data sheets on Industrial REX-FLEX. For specific recommendations send an outline of your requirements.

TYPICAL APPLICATIONS FOR INDUSTRIAL REX-FLEX

- *Weigh tank connections*
- *Superheated steam*
- *Conveying corrosive gases and liquids*
- *High temperature connections*
- *Vibration connections*
- *Vacuum hose*
- *Fireproof connections*
- *Conduit*
- *Offset motions*
- *Continuous flexations*
- *Air ducts*
- *Exhaust connections, etc.*

WRITE FOR CATALOG

Industrial REX-FLEX is part of Flexonics' complete line of flexible metal hose. Other types are described in Catalog 132. Or see the Flexonics catalog in Sweet's File for Product Designers.

Flexonics *Corporation*

CHICAGO METAL HOSE DIVISION

1305 S. THIRD AVENUE • MAYWOOD, ILLINOIS

FORMERLY CHICAGO METAL HOSE CORPORATION

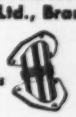
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Flexon identifies products of Flexonics Corporation that have served industry for over 52 years.

Flexible metal hose

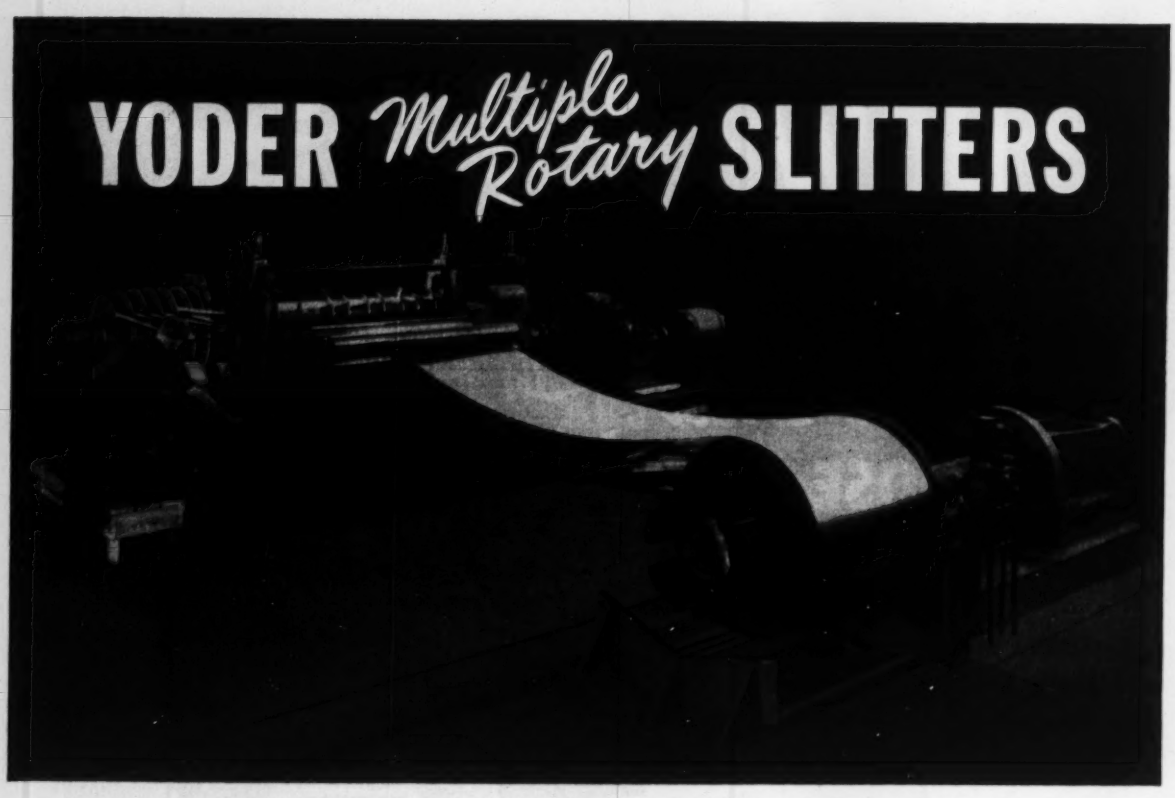
Expansion joints

Aircraft components



Metallic bellows

YODER *Multiple Rotary* SLITTERS



pay Four Kinds of Dividends

If you use 100 tons or more of coiled strip or sheets per month, in special widths, the installation of a Yoder Slitter will pay four kinds of dividends:

1. Savings of $10 to $30 per ton by buying standard widths instead of slit strands. This saving alone often pays for the Slitter investment in a year or less.

2. You can buy standard widths competitively, wherever you can obtain the best quality, price and delivery.

3. Greatly reduced inventory requirements. From a relatively small stock of standard widths you can meet your own needs for special widths in a few hours.

4. Better control of production schedules since slitting service no longer is a problem.

Yoder slitters, uncoilers, recoilers and other accessories are made in many sizes and capacities, from the smallest to the largest. The Yoder Slitter Book is a treatise on the economics as well as mechanics of slitter operation—send for it.

THE YODER COMPANY • 5499 Walworth Ave., Cleveland 2, Ohio

Complete Production Lines

- ★ **COLD-ROLL-FORMING and auxiliary machinery**
- ★ **GANG SLITTING LINES for Coils and Sheets**
- ★ **PIPE and TUBE MILLS—cold forming and welding**

ENGINEERING YODER MANUFACTURING

Consider the unique K-Weld technique...

when critical piping is the order!

With today's operating conditions already approaching the limits of available power piping materials, the necessity for expert fabricating techniques cannot be overstressed. And it is here that the K-Weld process, Kellogg's unique welding method, has already played an important part.

For example, K-Weld was used throughout—both in the shop and in the field—for the welding of austenitic stainless steam piping for service at 1100°F and 2350 psig on two 145,000 Kw units in Kearny station of Public Service Electric and Gas Co. of New Jersey.

Main advantage of this new welding process lies in the fact that it assures *complete penetration without backing rings*. Their elimination precludes the possibility of crack propagation at the weld root which would produce ultimate failure as a result of severe operating conditions.

An additional advantage is the elimination of the possibility of the backing ring breaking off and damaging equipment. Furthermore the lack of a ring materially reduces turbulence in pipes.

The K-Weld process—developed in Kellogg's Welding and Welding Practices Group—entails the use of inert-gas arc welding of the first pass with inert-gas under *controlled pressure* on the inside of the piping. It permits an average welder qualified for inert-gas arc welding to obtain excellent results either in the field or in the shop. The K-Weld technique may be used on all power piping materials.

Fundamental development work leading to advances in the art of fabrication is an important part of Kellogg's basic stock in trade. Many power station designers and utility companies also say it's one basic reason why they time and again specify Kellogg when critical power piping is the order.

New Power Piping Booklet Published . . . Send for descriptive literature about Kellogg's extensive facilities for assuring the highest quality workmanship. A section of the booklet is devoted to detailed coverage of the K-Weld process.

These leading companies are among the many major producers of power who use M. W. KELLOGG POWER PIPING...

- Consumers Power Co
- Detroit Edison Co.
- Dow Chemical Co.
- Elektricitetsselskabet Isefjordvaerket (Denmark)
- Ford Motor Co. of Canada Ltd. (Canada)
- General Electric Co.

OTHER FABRICATED PRODUCTS include: Pressure Vessels . . . Vacuum Vessels . . . Fractionating Columns . . . Drums and Shells . . . Heat Exchangers . . . Process Piping . . . Bends and Headers . . . Forged and Welded Fittings

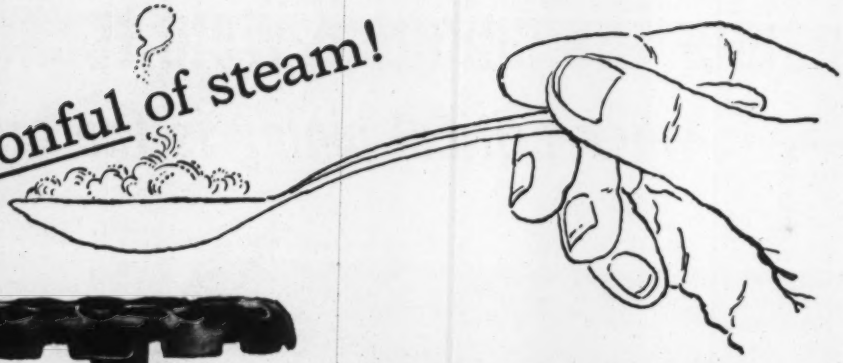
FABRICATED PRODUCTS DIVISION

M. W. KELLOGG

M. W. KELLOGG — Subsidiary of PULLMAN Incorporated

M. W. KELLOGG
HIGH TEMPERATURE
HIGH PRESSURE
POWER PIPING
M. W. KELLOGG
HIGH TEMPERATURE
HIGH PRESSURE
POWER PIPING
M. W. KELLOGG
HIGH TEMPERATURE
HIGH PRESSURE
POWER PIPING

a teaspoonful of steam!



HERE'S THE ANSWER
TO YOUR SMALL FLOW
CONTROL PROBLEMS

a NEW LESLIE REDUCING VALVE

for accurate, foolproof regulation of small flows of steam, air, gas or liquids, with inlet pressures to 1000 psi and reduced pressures from 2 to 400 psi.

Change operating conditions quickly and easily with simple, handwheel adjustment —no need to waste time changing springs or swapping parts. Check these widely accepted Leslie features that are standard in the new, efficient, Leslie Small Flow Reducing Valve.

Check these features

- ✓ Simple, compact construction
- ✓ Top quality materials
- ✓ Metal Diaphragm
- ✓ Entirely enclosed—no stuffing boxes
- ✓ Corrosion resistant springs
- ✓ Hardened stainless steel valve
- ✓ Interchangeable inner valves

SEND FOR DESCRIPTIVE BULLETIN 511-A WITH *COMPLETE* CAPACITY TABLES

Before you order—

The new Class LCB is just one of the many units that are *special* with most manufacturers but are *standard* with Leslie.

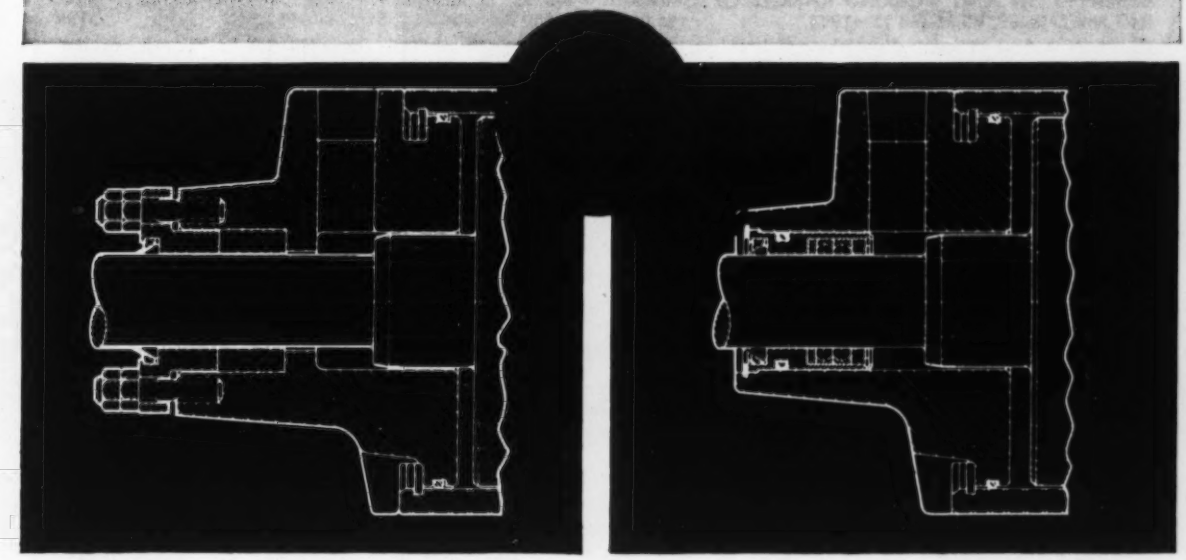
Check to see if any pressure, temperature or level control you want is standard with Leslie, before you order. Play it safe. Your Leslie Engineer is listed under "Valves" or "Regulators" in the classified telephone directory in principal cities.

TRADE LESLIE MARK

THE FIRST NAME IN PRESSURE, TEMPERATURE AND LEVEL CONTROLS
Since 1900

LESLIE CO., 287 Grant Avenue, Lyndhurst, New Jersey

Waldes Truarc Ring Saves $2.84 Per Unit, Cuts Labor-Time and Materials in Hydraulic Packing Unit



OLD STYLE stuffing box required skilled worker to install packing rings one at a time, then adjust packing glands by trial and error. Disassembly was equally difficult, time-consuming and costly.

NEW Monopak Cartridge is smaller, lighter, streamlined and installed with one Truarc Retaining Ring. Disassembly and reassembly with new cartridge takes unskilled worker just 1 minute.

Hydraulic Accessories Company of Van Dyke, Michigan, uses a single Waldes Truarc Inverted Ring (internal series 5008) to hold Monopak Cartridge in cylinder head.

New design eliminates costly machining and saves 2⅛ lbs. of material. Re-design with Waldes Truarc Retaining Ring reduces stuffing box diameter from 3½" to 2⅞", and reduces length from 5⅞" to 4⅜". Allows savings in assembly, adjusting and testing.

NEW DESIGN USING WALDES TRUARC RING PERMITTED THESE SAVINGS PER UNIT

MACHINE TIME SAVED:	
Chucking, facing and boring	$ .72
Drilling and tapping 3 holes	.18
Drilling and counterboring 3 holes	.12
Assembling, adjusting, testing	.90
MATERIAL SAVED:	
1⅛ lbs. cast iron	.30
½ lb. bronze	.23
3 studs	.36
3 nuts	.03
TOTAL	$2.84

Waldes Truarc Retaining Rings are precision-engineered . . . quick and easy to assemble and disassemble. Always circular to give a never-failing grip. They can be used over and over again. There's a Waldes Truarc Ring to answer every fastening problem.

Find out what Waldes Truarc Retaining Rings can do for you. Send your blueprints to Waldes Truarc engineers for individual attention, without obligation.

For precision internal grooving and undercutting . . . Waldes Truarc Grooving Tool.

See the Waldes Truarc exhibit at the A.S.T.E. Show, April 26-30. Booth No. 424, Precision Hall.

SEND FOR NEW CATALOG

WALDES

TRUARC

REG. U. S. PAT. OFF.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS: 2,382,047; 2,382,940; 2,410,052; 2,420,921; 2,425,341; 2,439,769; 2,441,046; 2,455,165; 2,483,380; 2,483,383; 2,487,002; 2,487,503; 2,491,306; 2,509,081 AND OTHER PATENTS PENDING

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.

Please send me the new Waldes Truarc Retaining Ring catalog.

(Please print) ME-046

Name.....

Title.....

Company.....

Business Address.....

City..... Zone..... State.....

★

A Check List of 1953-1954 American Standards Published by the ASME

MACHINE TOOLS

DESIGNATION AND WORKING RANGES OF GRINDING MACHINES, B5.32 and 33—1953. $1.00
Provides a method of identifying machine tools so that a user can specify reasonable similar sizes and capacities by means of simple designation. The section on reciprocating table surface grinders covers all sizes having horizontal spindles, and recommends the wheel sleeve diameters, width and length of working surface, the longitudinal transverse and vertical travel. The second section deals with the swing of plain cylindrical grinding machines up to and including the 36 inch size.

KNURLING, B5.30—1953. $1.00
Covers knurling tools with standardized diametral pitches and includes dimensional relations with stock in the production of straight, diagonal and diamond knurling on cylindrical surfaces having teeth of uniform pitch parallel to the axis of the cylinder or at a helix angle not exceeding 45 deg with axis of work, such knurling being made by the displacement of the material on the surface when rotated under pressure against a knurling tool.

INVOLUTE SPLINE AND SERRATION GAGES AND GAGING, B5.31—1953. $1.25
Applies to gages used for different types of fits, and several systems of gaging to meet the demands of various industries. Factors affecting fits and their control, working and inspection gages, inspection methods, machining tolerances and allowable errors are among the subjects covered.

MACHINE TAPERS, B5.10—1953. $1.00
Presents basic dimensions of twenty-two sizes of self-holding tapers, detailed dimensions and tolerances for self-holding taper shanks and sockets, dimensions and tolerances for the plug and ring gages applying to this series of tapers, and the dimensions for twelve sizes of steep machine tapers.

SPINDLE NOSES AND ARBORS FOR MILLING MACHINES, B5.18—1953. $1.00
Contains the essential dimensions of spindle noses, of ends of arbor and adapter, and of draw-in bolt end; also sketches of selective types of drive key construction.

SAFETY CODES

PRIVATE RESIDENCE ELEVATORS, A17.1.5—1953. $1.00
Shows how to install a small electric passenger elevator or inclined lift in a private residence or in a multiple dwelling as means of access to a private residence in such a building.

MECHANICAL POWER TRANSMISSION APPARATUS, B15.1—1953. $1.00
This Code modifies and clarifies many of the rules of the 1935 document and contains a number of new requirements. Dealing with the guarding of all revolving and reciprocating equipment used in the transmission of power, it provides for the safeguarding of connecting rods, cranks, flywheels, shafting, pulleys, belts, link belts, chains, ropes and rope drives, gears, sprockets, friction drives, cams, couplings, clutches, and counterweights up to point of operation, also all bolts, keys, set screws, oil cups, or similar projections.

PIPE AND FITTINGS

BRASS OR BRONZE FLANGES AND FLANGED FITTINGS —150 AND 300 LB. B16.24—1953. $1.00
In addition to approved dimensions and tolerances the Standard recommends pressure ratings; sizes and method of designating openings of reducing fittings; marking; bolts, nuts and gaskets; threading; and facing.

CI SCREWED DRAINAGE FITTINGS, B16.12—1953. $1.00
To bring this Standard in line with current practice, portions of the text and illustrations have been revised, and dimensions for Tucker Y-branch and Tucker and Roof connections and for P-traps, bath traps and running traps have been added. The other dimensions in its pages are for threaded ends; center-to-end of elbows; tees, crosses and Y-branches; couplings; increases; and offsets.

STEEL PIPE FLANGES AND FLANGED FITTINGS, B16.5—1953. $3.00
This is a completely new edition. Its tables have been rearranged for easier use, much of the text has been revised, and new material and tables have been added. The Standard pertains to cast and forged steel flanges and flanged fittings, also to **cast and forged steel flanged and butt welding end valves.** It gives the pressure ratings, sizes and methods of designating openings, markings, minimum requirements for materials, dimensions, tolerances and tests for 150, 300, 400, 600, 900, 1500, 2500 lb. steel pipe flanges and flanged fittings.

SYMBOLS

LETTER SYMBOLS FOR ACOUSTICS, Y10.11—1953. $1.00
This list contains the letter symbols for use in acoustical work.

LETTER SYMBOLS FOR METEOROLOGY, Y10.10—1953. $1.00
Sets forth the general principles of letter symbol standardization, and the approved symbols for primary and secondary concepts.

LETTER SYMBOLS FOR RADIO, Y10.9—1953. $1.00
Contains two listings—one in order of quantity and another in order of symbol (Roman and Greek).

MISCELLANEOUS

BUTTRESS SCREW THREADS, B1.9—1953. $1.00
Here are illustrated and described the characteristics of the basic form of thread, the preferred diameters and pitches, a formula for calculating pitch diameter tolerances, the tolerances for major and minor diameters, a system of allowances between mating parts, and methods of gaging.

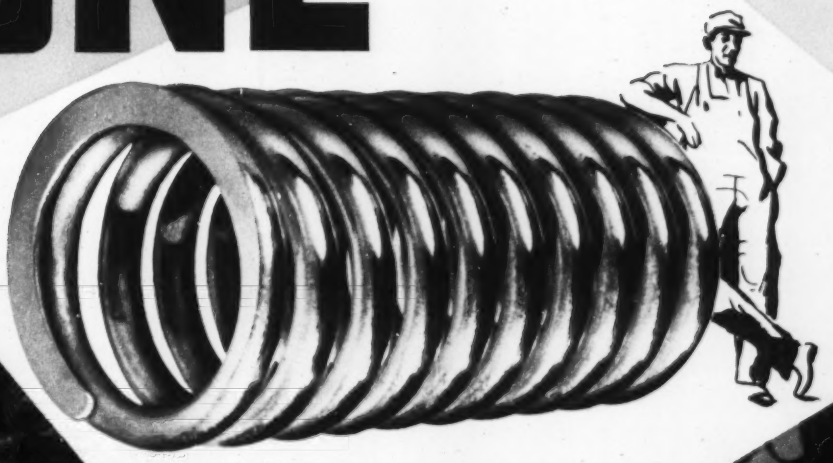
SMALL SOLID RIVETS, B18.1—1953. $1.00
This Standard covers size, proportions, dimensions, fillet radii, tolerances, ductility and hardness tests, and finish of the following types: Flat head, countersunk head, button head, pan head, truss head, tinners', coppers', and belt rivets.

PLAIN WASHERS, B27.2—1953. $1.00
Limited to 77 different combinations of I.D., O.D., and thickness, the Standard provides an adequate selection for the majority of general purpose applications. Sizes include those in the SAE Standard, and the manufacturers' wrought washer series, and some additional sizes. New material covers general applications, materials and thickness.

20% Discount to ASME Members

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
29 W. 39th St., New York 18, N. Y.

ONE



or a MILLION

Divisions of ASSOCIATED SPRING CORPORATION

WALLACE BARNES COMPANY BRISTOL, CONNECTICUT	**THE WILLIAM D. GIBSON COMPANY** 1800 CLYBOURN AVE. CHICAGO 14,	**RAYMOND Manufacturing COMPANY** CORRY, PENNSYLVANIA	**BARNES-GIBSON-RAYMOND** 40300 PLYMOUTH RD. PLYMOUTH, MICH.	**B·G·R COOK PLANT** ANN ARBOR MICHIGAN	10 PROVEN SOURCES COAST TO COAST
F. N. MANROSS AND SONS CO. BRISTOL CONNECTICUT	**OHIO DIVISION** 1825 EAST FIRST ST. DAYTON, OHIO	**DUNBAR BROTHERS COMPANY** BRISTOL, CONN.	**MILWAUKEE DIVISION** 341 E. ERIE ST. MILWAUKEE, WIS.	**SEABOARD Coil Spring Div.** 15001 S. BROADWAY GARDENA, CALIF.	

IN CANADA - The WALLACE BARNES CO., Ltd., Hamilton, Ontario

You don't have to look far...

for

GOOD SPRINGS

Divisions of ASSOCIATED SPRING CORPORATION

WALLACE BARNES COMPANY
BRISTOL, CONNECTICUT

THE WILLIAM D. GIBSON COMPANY
1800 CLYBOURN AVE. CHICAGO 14,

RAYMOND Manufacturing COMPANY
CORRY, PENNSYLVANIA

BARNES-GIBSON-RAYMOND
40300 PLYMOUTH RD. PLYMOUTH, MICH.

B-G-R COOK PLANT
ANN ARBOR MICHIGAN

10 PROVEN SOURCES COAST TO COAST

F. N. MANROSS AND SONS CO.
BRISTOL CONNECTICUT

OHIO DIVISION
1825 EAST FIRST ST. DAYTON, OHIO

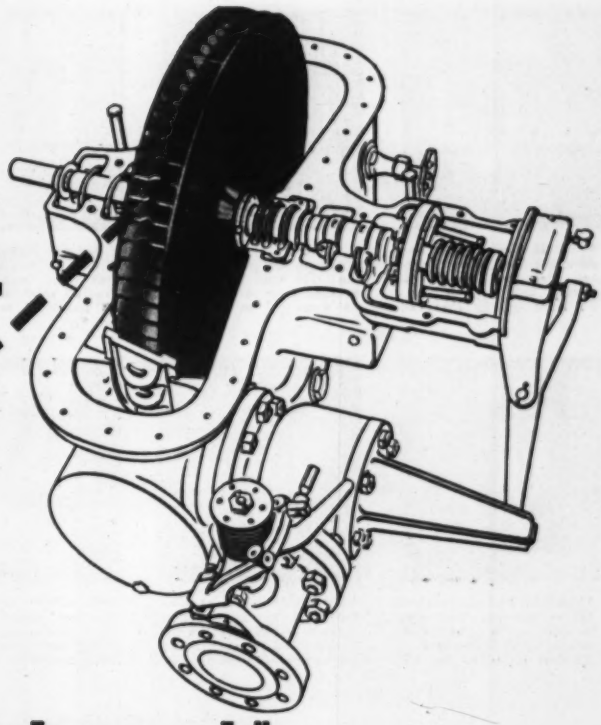
DUNBAR BROTHERS COMPANY
BRISTOL, CONN.

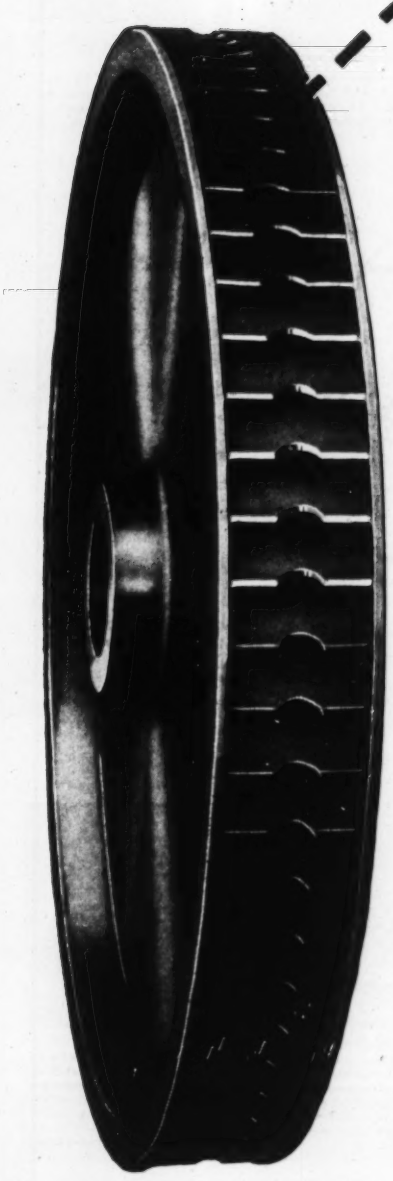
MILWAUKEE DIVISION
341 E. ERIE ST. MILWAUKEE, WIS.

SEABOARD Coil Spring Div.
15001 S. BROADWAY GARDENA, CALIF.

IN CANADA - The WALLACE BARNES CO., Ltd., Hamilton, Ontario

TERRY SOLID WHEEL





..."trade mark" of a trouble-free turbine

This is the rotor of a Terry solid-wheel turbine. There are a number of reasons why it has become a symbol for reliable, trouble-free operation.

First, because the wheel is a single forging, in which a series of semi-circular buckets is milled, there are no separate parts to become loose or work out.

Second, because the power-producing action of the steam takes place on the curved surfaces at the back of the buckets, blade wear is of little consequence. Wear does not materially affect horsepower or efficiency.

Third, because the steam enters the buckets in a direction at right angles to the shaft, there is no need for close axial blade clearances. The blades cannot foul. There is a one inch clearance on either side of the wheel. In addition, the blades are double rim protected.

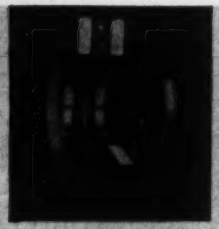
These are only a few of the reasons why the Terry solid wheel has become a "Trade Mark" for trouble-free turbine performance. For complete details, send for a copy of bulletin S-116. No cost or obligation.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TERRY

TT-1197

B SERIES • Light duty, one direction ball thrust bearing. Flat seat. Flat races. Bronze ball retainer . . . 28 sizes ½" to 3½" I.D.



C SERIES • Light duty, one direction ball thrust bearing. Flat seat. Flat races. Pressed steel retainer . . . 16 sizes ½" to 1⅞" I.D.

F SERIES • Light duty, one direction thrust bearing. Flat seat. Grooved races. Pressed steel retainer . . . 42 sizes ½" to 3½" I.D.

G SERIES • Medium duty ball thrust bearing. Grooved races. Pressed steel or bronze (large sizes) retainer . . . 76 sizes ½" to 7½" I.D.

S SERIES • Medium duty ball thrust bearing. Banded. Flat seat. Grooved races. Full complement of balls . . . 40 sizes ½" to 3½" I.D.

1000 SERIES • Light duty ball thrust bearing. Flat seat. Grooved races. Pressed steel retainer. Metric standard . . . 26 sizes 10 to 125 mm. I.D.

1100 SERIES • Medium duty ball thrust bearing. Grooved races. Pressed steel or bronze (large sizes) retainer . . . 23 metric sizes 10 to 140 mm. I.D.

1400 SERIES • Medium duty. Grooved races. Spherical seat. Pressed steel or bronze (large sizes) retainer . . . 23 metric sizes 10 to 140 mm. I.D.

W SERIES • Case hardened and ground flat washers for various Thrust and Spacer applications. Slip fit. 38 sizes ½" to 3½" I.D.

R SERIES • Ball thrust retainer. One piece, pressed steel, channel type cage . . . 79 inch sizes 0.265" to 4.232" I.D.

Judged by every quality and performance standard Aetna bearings measure up to modern industry's increasingly exacting needs. That's why Aetna has a customer list that reads like Who's Who in American Industry—why 80% of Aetna's business comes from firms it has served for 20 or more years. Aetna has specialized on the advanced development, production and application of high precision anti-friction products for nearly four decades. Be sure to give this valuable background of experience your serious consideration when planning improvements of your present products or developing new ones for future production. We welcome your inquiry.

CLUTCH BEARINGS • Ball thrust clutch release bearing. Banded. Pre-lubricated. T-type, oil impregnated bronze retainer assures concentricity and smooth, quiet, long-life performance.

Aetna

Precision Bearings and Parts for Every Drunch of Industry

AETNA BALL AND ROLLER BEARING COMPANY

DIVISION OF PARKERSBURG-AETNA CORPORATION

4600 SCHUBERT AVENUE CHICAGO 39, ILLINOIS

SPECIAL BEARINGS • Facilities for sizes up to 38" O.D. Counsel that brings you the expert technical aid that has licked many of industry's toughest bearing application problems.

PRECISION PARTS • Aetna is versatile—can mass-produce vital parts in almost limitless sizes and shapes—to your most exacting metallurgical, tolerance and finish specifications.

Write for latest catalog. Contains specifications on Aetna's complete line—vital technical reference data on bearing selection, load capacities, lubrication, care and maintenance.

NOTES

for the engineer's note book

. . . ON WHEELER-ECONOMY POWER PLANT EQUIPMENT

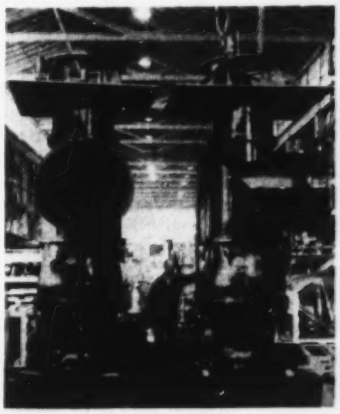
NO SHUTDOWN, NO LOAD REDUCTION, NO HAND CLEANING . . . WITH C. H. WHEELER *REVERSE FLOW* CONDENSERS

The savings in dollars and downtime effected by C. H. Wheeler's Reverse Flow design for steam condensers are a matter of record in public utilities and private power plants throughout the country. Chances are, you can inspect a nearby installation and learn first hand how efficiently debris of vegetable, animal and mineral matter is dislodged from the tube sheet and flushed away by reversing the flow of the cooling water through the Condenser. Cleaning work that formerly took hours is accomplished in minutes with no interruption in load. C. H. Wheeler custom-engineers your steam condensing hook-up to pay off in long range sustained efficiency. (Bulletins mailed on request.)

WHEELER - ECONOMY CIRCULATORS

Lasting Dependability
Minimum Maintenance

Wheeler-Economy Circulators include: mix-flow vertical wet pit type with both standard and pull-out design; vertical mix-flow volute type for dry pit installations; and horizontal single stage centrifugal constructions to 100,000 GPM capacities. Wheeler-Economy pumps for general service include: single stage high head double suction; multi-stage with horizontal or vertical split case; pumps for sump, process and fire protection services. Wheeler-Economy also invites your special problems requiring custom design. (Bulletins mailed on request.)



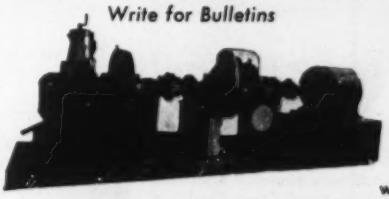
TUBEJET AIR EJECTORS

Steel Shell
More Reliable

C. H. Wheeler Steel Shell Tubejet Air Ejectors provide worthwhile savings in space and weight. They are available with either single or multiple element, two-stage type with combined surface inter-after condenser. Write for Bulletin.

WHEELER-ECONOMY CONDENSATE PUMPS
for Condenser Service
with Turbine and Motor Drive

Write for Bulletins



WE-400

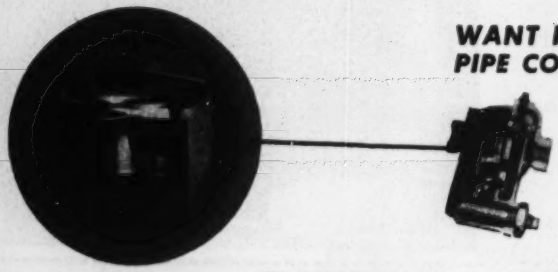
C. H. WHEELER of Philadelphia

C. H. WHEELER MANUFACTURING CO., 19th & LEHIGH, PHILADELPHIA 32, PENNA.

Steam Condensers • Centrifugal, Axial and Mixed Flow Pumps • Steam Jet Ejectors • Vacuum Refrigeration
High Vacuum Process Equipment • Micro Particle Reduction Mills • Marine Condensers and Ejectors • Deck Machinery

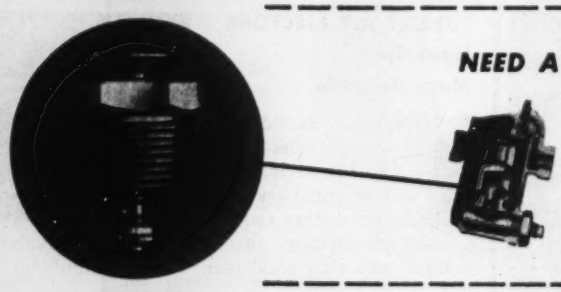
Here's a *Real*

STEAM TRAP PACKAGE



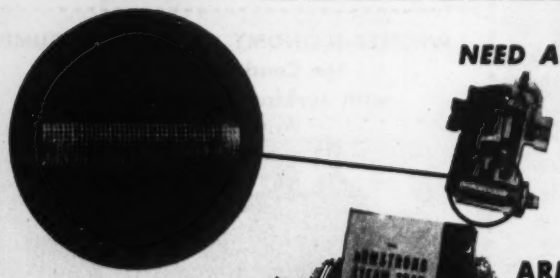
WANT FAST HEAT-UP OF OFF-AND-ON PIPE COILS, HEADERS, UNIT HEATERS, ETC.?

Speed heat-up with Armstrong thermic bucket traps. When steam is first turned on, air is pushed out the large thermic vent—fast! As soon as steam reaches the trap a thermic strip closes the vent, then the bucket functions as a regular bucket. Traps with thermic vent buckets discharge air 50 to 100 times faster than other traps.



NEED A CHECK VALVE AHEAD OF TRAP?

Just specify Armstrong with internal check valve. No check valve installation labor or fittings needed. Spring loaded action and vertical position minimize danger of dirt holding valve open. The Armstrong internal check valve is top quality—long lasting.



NEED A STRAINER AHEAD OF TRAP?

Save money with Armstrong built-in strainer traps. They cost less than a separate trap and strainer and save installation time and money. Stainless steel screen lasts a long time.

Get the full facts about all Armstrong traps. Send today for free Catalog J, The Armstrong Steam Trap Book.

ARMSTRONG MACHINE WORKS
894 Maple Street • Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

Meet the man you can call with confidence to solve your thermal insulation problems

To insulate outdoor tanks with complete weather protection, these skilled J-M applicators follow a specification developed by Johns-Manville. Here they are fastening J-M Asbestocite* Sheets over J-M Zerolite* Insulation. J-M 85% Magnesia Insulation is also widely used for this type of equipment

He is your J-M Insulation Contractor... the man with the world's most complete insulation engineering service

"Insulation is no better than the man who applies it." Today, with rising fuel and maintenance costs, it is especially important to place your insulation job in skilled hands. The scientific application of J-M quality insulations by J-M Insulation Contractors will assure you of the maximum return on your insulation investment for years to come. Moreover, you get undivided responsibility for *all* your insulation requirements.

1. You get dependable materials—Johns-Manville manufactures a complete line of insulations for every service temperature from minus 400F to plus 3000F. From them your J-M Insulation Contractor can select the right insulation for the most dependable service on your job. To develop new and improved insulation materials Johns-Manville maintains the J-M Research Center—largest laboratory of its kind in the world.

2. You get dependable engineering—For 95 years Johns-Manville has been accumulating insulation engineering experience. J-M Insulation Engineers are called upon to solve insulation problems of every type and magnitude, in every industry. Since your J-M Insulation Contractor works closely with J-M Insulation Engineers, he brings to *every* job a high degree of training, skill and experience.

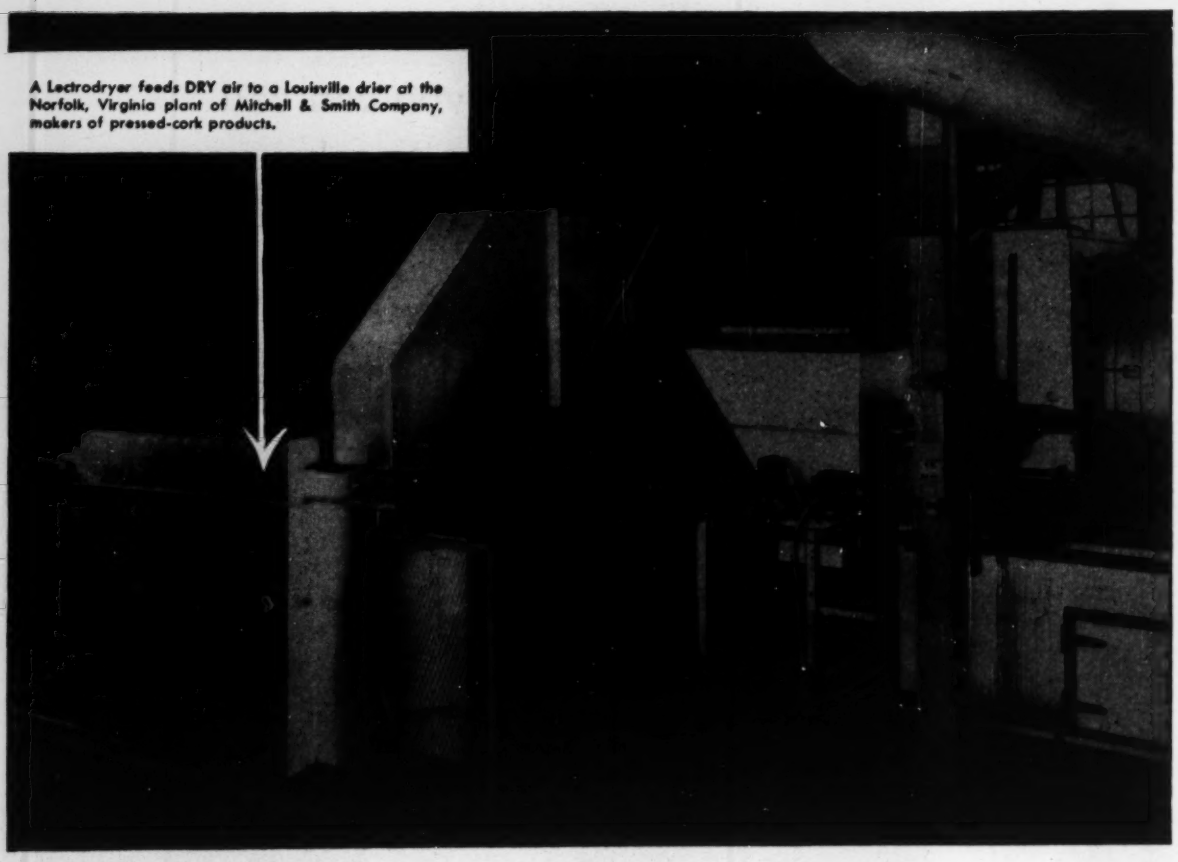
3. You get dependable application—Johns-Manville has set up a nationwide organization of J-M Insulation Contractors to serve you. These Contractors maintain staffs of insulation engineers as well as skilled mechanics thoroughly trained in J-M's proved application methods. You can have absolute confidence in their ability to apply J-M insulations correctly for trouble-free performance.

For further information and the name of your J-M Insulation Contractor, write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ont.

*Reg. U. S. Pat. Off.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION



A Lectrodryer feeds DRY air to a Louisville drier at the Norfolk, Virginia plant of Mitchell & Smith Company, makers of pressed-cork products.

DRY AIR is part of their formula in blending powdered cork

Formulation of cork products calls for some water, but not as much as the raw cork usually contains. Some of the moisture must be removed by tumbling the powdered cork in a rotary drier, through which heated DRY air is passed.

Lower air temperatures—desirable to prevent injury to the cork—can be employed when that air is preconditioned by a Lectrodryer,* since DRY air removes moisture faster.

You can make DRYing a part of your formulas by installing Lectrodryers to remove unwanted moisture from air, gases and organic liquids. Delicate chemical reactions can then be held on the straight and narrow path more easily. Low humidity in workrooms and storage areas prevents contamination of materials that pick up water. It keeps them moving freely in machines and conveyors, speeding up production.

For help in adding DRYing to your processes, write Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Penna.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

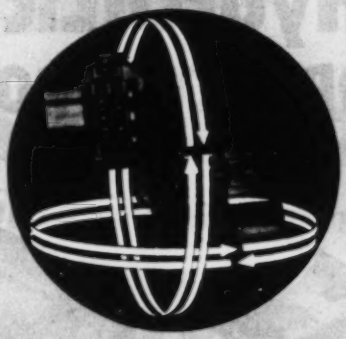
LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

* REGISTERED TRADEMARK U. S. PAT. OFF.

CHIKSAN

Chiksan swivel joints in landing gear, braking and hydraulic control systems on Lockheed's Super-Constellation.



THE NEW TOOL OF ORIGINAL EQUIPMENT MANUFACTURERS

Now Modern Industry has a *New* Tool available in CHIKSAN Ball Bearing Swivel Joints. These revolutionary flexible joints turn with full 360° rotation in 1, 2, and 3 planes, handling air, hydraulics, fuels, oils, water and other fluids.

There are over 1,000 different types, styles and sizes for pressures and services from 28" vacuum to 15,000 psi and for temperature ranges from minus 75° F. to a plus 500° F. Packing materials have been designed for each specific service.

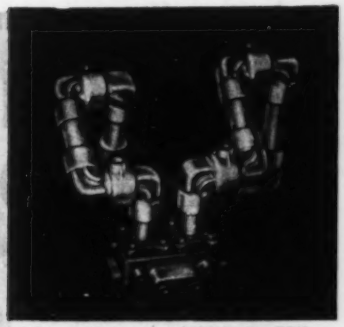
Wherever unlimited flexibility is required in your research, design and engineering of new equipment for modern industry—CHIKSAN will help you find the solution.

Write for Catalog 53-C. Dept. 4-'48

The Flow of Enterprise Relies on

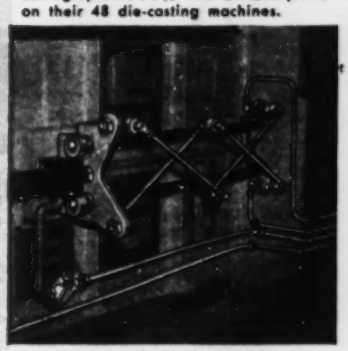
CHIKSAN

Ball-Bearing Swivel Joints



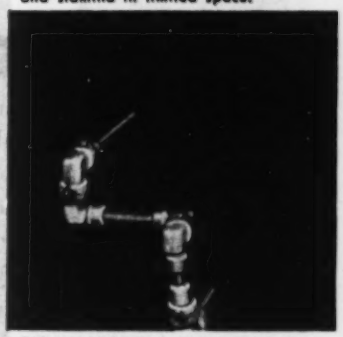
Johnson Motors cut fluid losses 75%—setting-up time 75% with Chiksan joints on their 48 die-casting machines.

Chiksan high-pressure swivel joints provide complete flexibility and safety in steam lines on platen presses.



Ermold automatic bottle unpacker uses Chiksan hydraulic joints for flexibility and stamina in limited space.

Most hose reel manufacturers employ Chiksan swivels for pressure and vacuum tight connections with low torque.



Chiksan high-pressure swivel joints are installed for dependability and safety in injection molding equipment.

Colorado School of Mines turned to Chiksan swivel joints for air and hydraulic lines on shale mining equipment.

Chiksan swivel joints are used on the coolant lines on the 160" plate mill in U. S. Steel's Homestead Works.

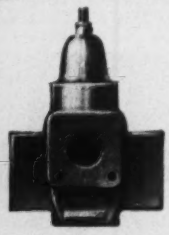
CHIKSAN COMPANY • BREA, CALIFORNIA • Chicago 28, Illinois • Newark 2, New Jersey

Well Equipment Mfg. Corp. (Division) Houston 1, Texas • Chiksan Export Company (Subsidiary) Brea, California • Newark 2 N J

For lasting efficiency with less maintenance, specify

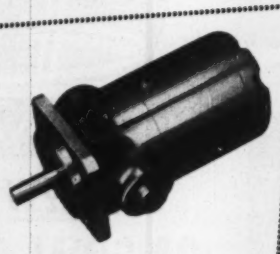
DENISON HydrOILic
PUMPS, MOTORS, CONTROLS
For circuit pressures to 5000 psi

SURGE-DAMPING CONTROLS
Industrial and Aircraft Types
Eliminate Destructive Hydraulic Pressure Shock
¼" to 1" Sizes
For Pressures to 5000 psi
Catalog VS-1-A

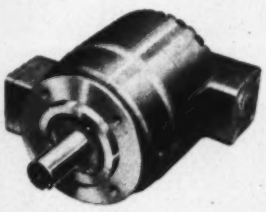


Direct-Operating PRESSURE CONTROLS
½" to 1½" Sizes
For Pressures to 2000 psi
Catalogs VRD-1 through VRD-8

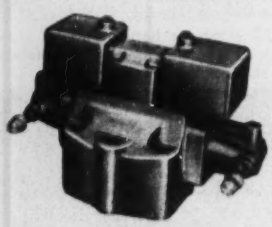
High-Pressure Axial-Piston PUMPS
Constant or Variable Volume
For 2500, 3000 and 5000 psi Circuit Needs
3.5 to 35 gpm Capacities
Catalogs P-4 through P-4-10



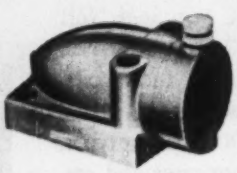
High-Torque Axial Piston FLUID MOTORS
Torque Ratings 13.8 to 112 inch-pounds per 100 psi (about 3 to 180 hp maximum)
For Pressures to 5000 psi
1500 to 3000 rpm
Catalogs FM-1, FM-2, FM-3-A



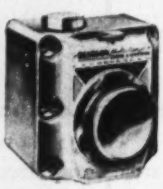
Dual-Purpose, Vane-Type PUMP/MOTOR
Ready for either pump or motor use without change
Shaft rotation in either direction
Four Sizes, 11 Models
Pumping Capacities: 3 to 82 gpm.
Motor Torque: 13 to 257 inch-pounds per 100 psi. Pressures to 2000 psi.
Bulletin P-5



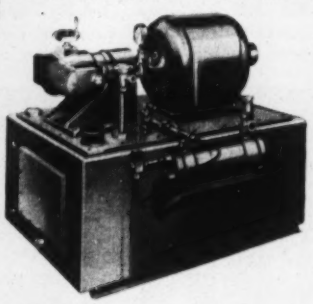
DIRECTIONAL CONTROLS
Manual, Mechanical, Electric or Pilot Control. ¼" to 2" Sizes
For Pressures to 5000 psi
Catalog VD-3



PRESSURE REDUCING VALVES
¾" to 1½" Sizes
20 gpm to 65 gpm Capacities
For Pressures to 5000 psi
Catalog VPR-1



Multi-Range FLOW CONTROLS
Full-Scale Regulation—Adjustable for Varying Input
¼" to ¾" Sizes
For Pressures to 3000 psi
Catalogs VFC-1, VFC-2



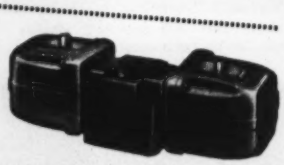
PUMPING UNITS
Constant and Variable Volume
46 Models—2 to 35 gpm Capacities
For Pressures to 5000 psi
Bulletins PU-3-A, PU-4 and PU-5

PROVED IN USE
under industry's toughest operating conditions

Denison HydrOILic Pumps, Motors and Controls are noted for their combination of high efficiency and rugged dependability.

In addition to fine performance under continuous, heavy-duty use, Denison HydrOILic Equipment offers space-saving design that simplifies circuit layout, makes installation easier, and minimizes maintenance problems.

Because so many users verify the extra value built into Denison Pumps, Motors and Controls, we continue the challenge made so often before—*let comparison prove to you* why they are first choice for so many needs of every type. Write today for full details on Denison HydrOILic Equipment to meet your requirements.



Pilot-Operated, Solenoid-Controlled DIRECTIONAL VALVES
Eliminate Spool-Sticking
¾" to 1½" Sizes, For Pressures to 5000 psi
Catalogs VD-1-1 to VD-4-2

DENISON HydrOILics
PUMPS | MOTORS | CONTROLS | PRESSES

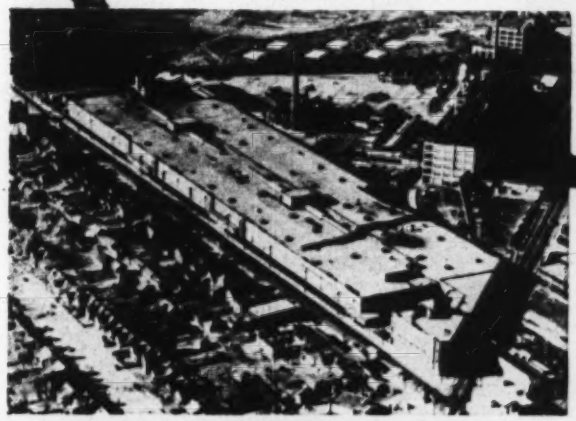
Be Sure To See DENISON BOOTH #1400 at ASTE SHOW

"The Finest Money Can Buy!"

The DENISON Engineering Company, 1189 Dublin Road, Columbus 16, Ohio

DETROIT STOKERS

in two *Eli Lilly and Company plants*

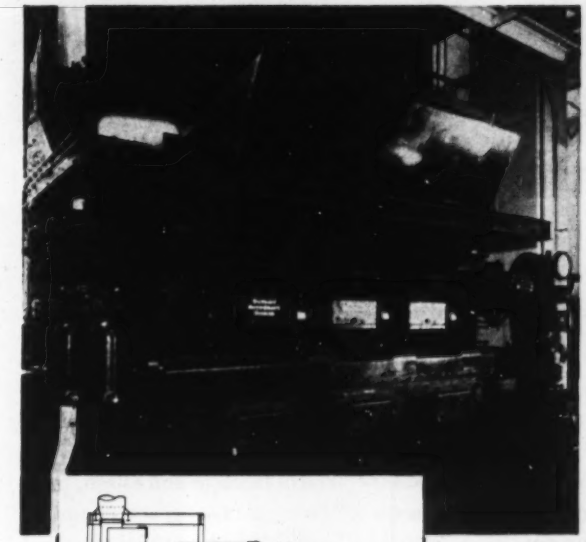


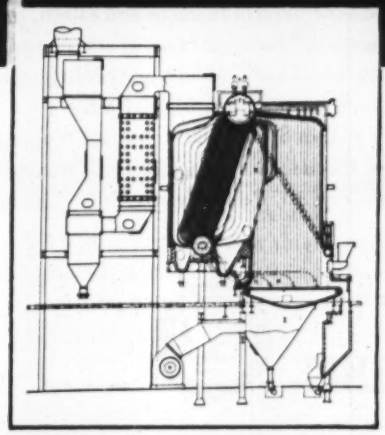
FOUR CONTRACTS

High efficiency with low maintenance—ability to handle rapidly fluctuating loads, and cleanliness are Detroit Stoker features that appealed to Eli Lilly and Company engineers.

Cleanliness—elimination of sources of possible contamination—is of paramount importance to plants making thousands of medicinal products having the highest reputation for purity.

At the left one of the two Detroit RotoGrate Stokers at the Lilly Indianapolis plant. Capacity each Babcock and Wilcox unit 75,000 pounds per hour. RotoGrates also are in service at their new Tippecanoe Laboratories, Lafayette, Indiana.





Write for Catalog—No Obligation.

DETROIT *SINCE 1898* **STOKERS**

DETROIT STOKER COMPANY

GENERAL MOTORS BLDG., DETROIT 2, MICH.

District offices in Principal Cities • Works in Monroe, Mich.

The Dana Warp Mills took advantage of Life-Line Gearmotors' compactness and operating efficiency. Shown is a Life-Line Gearmotor driving a delivery roll on a slasher.

Close-Quarter Servicing No Problem when your drive is a Westinghouse Gearmotor

Powering equipment at the Dana Warp Mills meant putting compact and dependable drive units into cramped quarters. To meet space limitations, designers carefully selected gearmotors with minimum size and definite servicing advantages . . . they specified Life-Line Gearmotors.

Integral design of Life-Line Gearmotors provides maximum saving in space and means no intricate coupling or alignment problems.

Inspection and servicing of Life-Line Gearmotors is simple. Sight gauges on both sides of gear case enable quick detection of oil level. The gear case is split horizontally and by removing a few bolts, the gear cover can be lifted clear of the unit. This simple operation makes all working parts accessible without draining oil or disturbing the unit mounting. Machine alignment remains true.

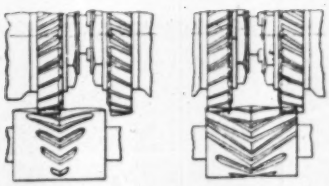
Life-Line* motor features and tough, precision-made Westinghouse gears combine to give Life-Line Gearmotors lasting stamina, even on the most rugged jobs.

For detailed information, write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-07323

*Trade-Mark

YOU CAN BE SURE...IF IT'S

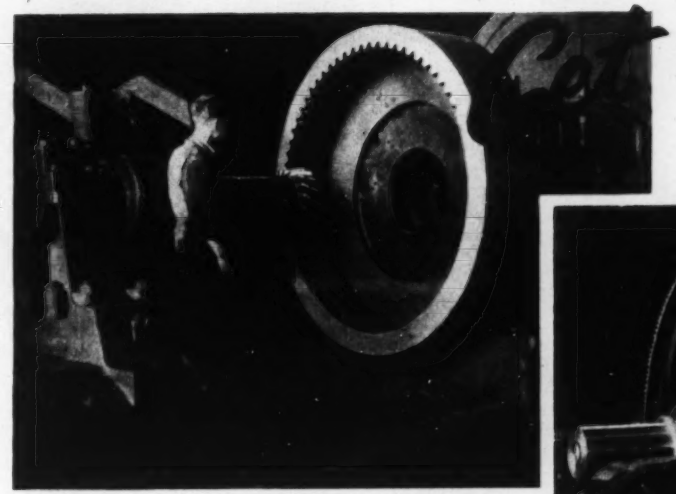
Westinghouse



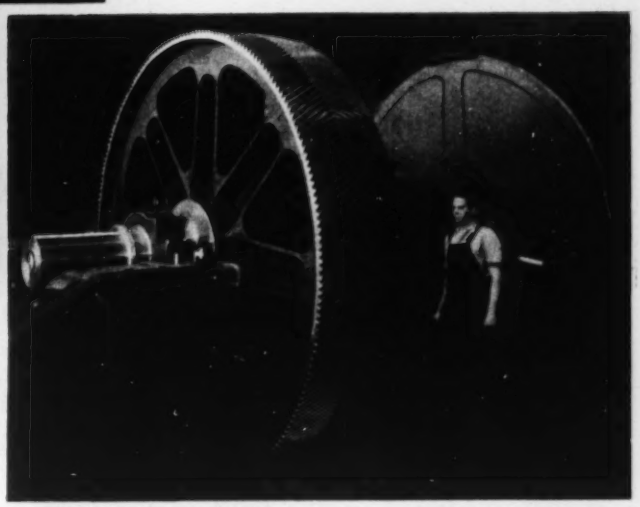
For generating double helical gears, the Farrel-Sykes machine is equipped with two cutters mounted on a single carriage. The cutters reciprocate, each ending its stroke at the center of the blank. As they cut, they twist to generate the helices and also slowly revolve in unison with the gear blank to generate the tooth contours precisely. For single helical gears one cutter is used, and for spur gears either one or two cutters may be used.

how precision gears

Precision



Farrel-Sykes machine generating an internal single helical gear.



Generating a large herringbone gear in the Farrel-Sykes machine.

Precision comes to gears through the machine that makes them. It is passed on to Farrel® gears by the Farrel-Sykes Gear Generator, the operating principle of which (precision generation) gives the gears accurate tooth spacing, profile and helix angle. Because of this you can be sure that Farrel gears will operate smoothly, quietly and efficiently throughout a long service life.

Farrel continuous tooth herringbone gears are made in any size from ¼" to 20'0" diameter, for any power capacity and speed. Also available are straight tooth and single helical gears in sizes up to 20'0" in diameter, and large internal gears with either spur or helical teeth.

Farrel engineers will be glad to assist you in working out unusual gear problems.

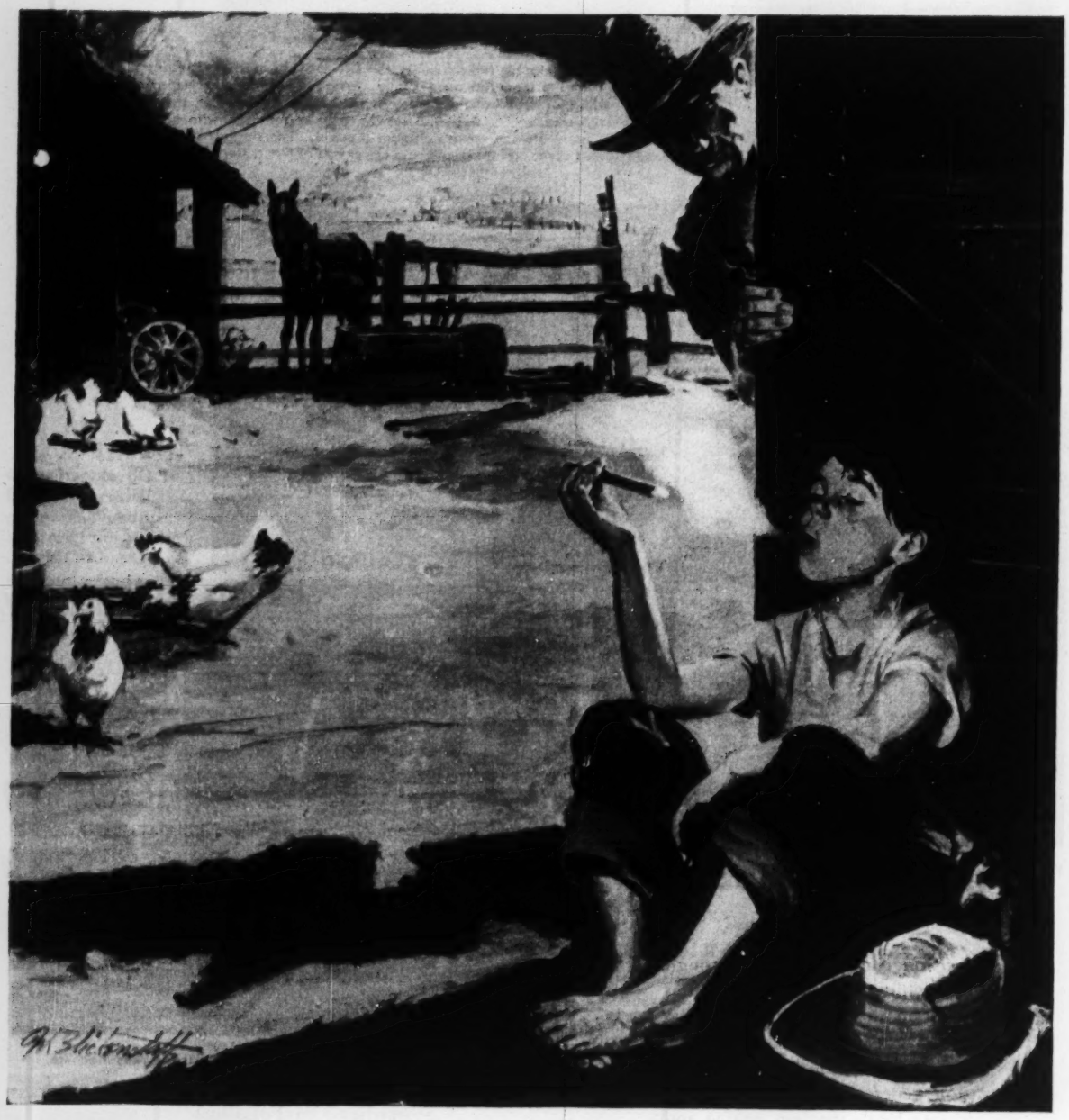
FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.

Sales Offices: Ansonia, Buffalo, New York, Boston, Akron, Detroit, Chicago, Memphis, Minneapolis, Portland (Oregon), Los Angeles, Salt Lake City, Tulsa, Houston, New Orleans

FB-876

Farrel-Birmingham®



Coming events...!

One way or another, something's going to happen to that barefooted adventurer, above. And business has arrived at a turn in the road, too. When all restraints are off and materials are in easy supply, you always find competition much keener and customers a lot more choosey. ● Right now, you'll bless the competitive edge that stainless steel can give you. "*Looks better*"..."*Stronger*"..."*Lighter*"..."*Can't rust*"..."*Lasts a lifetime*"..."*Keeps cleaner*"..."*Saves on upkeep*"..any one or all of these advantages can be yours with Allegheny Metal. Let us help yo · get them. ***Allegheny Ludlum Steel Corporation. Oliver Bldg., Pittsburgh 22, Pa.***

You can make it BETTER with

Allegheny Metal

AL® TIME-TESTED STAINLESS STEEL

Warehouse stocks carried by all Ryerson Steel plants

WAD 4818A

What size is a quality fastener?

Here are two ELASTIC STOP® nuts.
Each has the familiar red locking collar. Each is self-locking, vibration-proof and can be reused many times. Each is a fast, readily assembled one-piece unit . . . will maintain accurate adjustment anywhere on a bolt. Each will afford positive protection against thread corrosion . . . prevent liquid seepage along bolts. Each is manufactured in quantity. Each is exactly controlled as to quality of raw material, finished dimensions, class of thread fit, seat squareness and finish. Each has a record for precision and uniformly high performance that is unmatched.

But . . . one measures 1/10 inch across the flats; the other, 4 inches. Between these two, there are more than 530 different hex nuts in the ESNA line. They are the result of variations in height, material, finish and size.

Look to ESNA for the top quality self-locking fastener that fits your need best.

ELASTIC STOP NUT CORPORATION OF AMERICA

ESNA TRADE MARK

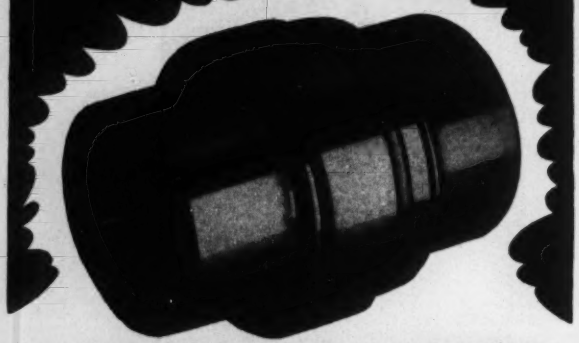
ROLLPIN TRADEMARK

Elastic Stop Nut Corporation of America
Dept. N58-411, 2330 Vauxhall Road, Union, N. J.
Please send the following free fastening information:

☐ ELASTIC STOP nut bulletin ☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name _____ Title _____
Firm _____
Street _____
City _____ Zone _____ State _____

Smooth... Power Transmission



LOVEJOY FLEXIBLE COUPLINGS

MODERN DESIGNers specify *Lovejoy Flexible Couplings* because they offer the best obtainable insurance against alignment troubles—dampen and absorb starting torque, vibration and shock of intermittent loads ... protect motor and driven machine ... lengthen bearing life. *Lovejoy Flexible Couplings* are rugged in construction, provide excellent resiliency. Bodies are carefully machined. Cushions are available in materials suited to the particular load conditions ... can be changed without shutdown. No lubrication is needed.

WRITE TODAY FOR FREE ILLUSTRATED CATALOG WITH HANDY SELECTOR CHARTS.

Also Mfrs. of Lovejoy Universal Joints and Lovejoy Variable Speed Pulleys

LOVEJOY FLEXIBLE COUPLING CO.
4832 W. LAKE ST., CHICAGO 44, ILL.

install peak performance into your compressors (AIR • GAS • AMMONIA)

J.H.H. VOSS VALVES
REG. U.S. PAT. OFF.

Peak performance, maximum efficiency, greater output, and lower power costs can be built into your oldest, and of course your newest, compressors by the installation of VOSS VALVES.

Check **THESE VOSS VALVE ADVANTAGES:**

✓ Quiet, vibration-free operation ✓ 20 to 60% more valve area ✓ less power consumption ✓ minimum pressure loss ✓ normal discharge temperature ✓ lower operating costs ✓ utmost safety

Our detailed proposal for increasing the efficiency of your compressor will be sent you without obligation. Send us the name, bore, stroke, and speed of your machine.

VOSS VALVES / J. H. H. VOSS Co., Inc.
784 East 144th Street, New York 54, N. Y.

The NEWEST development in V-ring packings

LINEAR VEE-DAM* RINGS

Foolproof to assemble
leakproof in operation

Moulded in rubber dams seal off labyrinth and lateral flow even when gaps occur in the ring joint through faulty installation. Precision moulded of fabric reinforced synthetic rubber. Write for details.

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR Inc., State Rd. & Levick St., Philadelphia 35, Pa

new catalog describes the

MOST ECONOMICAL HEATING SURFACE ON THE **MODERN** BOILER

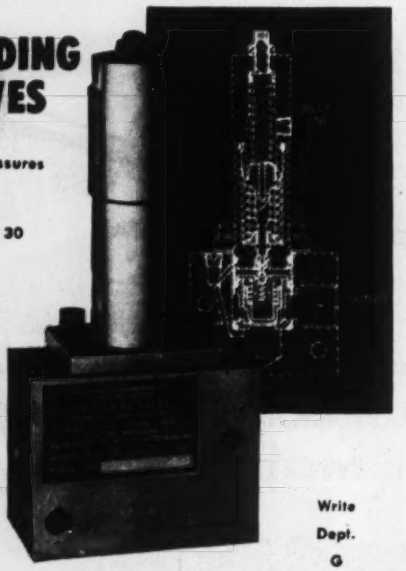
. . . that's the way to describe the Ljungstrom Air Preheater. For any boiler above 25,000 pounds per hour capacity — there's a Ljungstrom to cut your fuel costs . . . increase steam capacity . . . lower maintenance costs.

This new catalog includes detailed descriptions of the Ljungstrom Air Preheater, and illustrations showing how it is mounted on boilers of many different capacities. Included, too, are reasons why the Ljungstrom is so reliable . . . easy to maintain . . . resistant to corrosion.

FOR YOUR FREE COPY, WRITE TODAY TO THE AIR PREHEATER CORPORATION

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

UNLOADING VALVES



For system pressures to 3000 psi

Flow rates to 30 G. P. M.

Waterman Unloading Valves are fast-acting, long-lived, easily adjustable. Maintain desired pressure settings without continuous readjustment.

Write Dept. G for circular

Hardened and ground poppets and seats eliminate leakage.

Large internal passages assure maximum flow with a minimum pressure loss.

No external drain lines required.

Waterman Engineering Company

725 CUSTER AVENUE • EVANSTON, ILLINOIS

Imperial

THE *Finest* TRACING CLOTH

Imperial is known in drafting rooms all over the world as the traditional quality tracing cloth.

With the background of decades of experience, its makers have pioneered in modern improvements to maintain Imperial as the finest tracing cloth made.

Economy in pilot or development small lots as well as in program production can be achieved by consultation with Lenape for recommendations on seamless or weldment construction requiring:

- Circular or symmetrical flanged or flued members of ¼" to 4" rolled plate stock.
- Upset flanged or plain forged and pierced rings.
- Truncated or closed cones.

Expanded facilities have extended our range of capacity. Mail sketch or print direct, or consult nearest representative.

Take Advantage of

LENAPE CUSTOM FORMED PRODUCTS

LENAPE HYDRAULIC PRESSING AND FORGING CO.

LENAPE HYDRAULIC PRESSING & FORGING CO.
DEPT. 112 WEST CHESTER, PA.
RED MAN PRODUCTS

MECHANICAL ENGINEERING
March, 1954 CARD INDEX Vol. 76, No. 3

Product Design of the Brownie Movie Camera, M. E. Brown	227
Operations Research, P. M. Morse	231
A Report on Progress in Railway Mechanical Engineering 1952–1953	236
Industrial Hard-Chromium Plating, Warren Schmidt and W. E. Hogan	248
The Wheel Manufacturer Looks at Railroading, C. B. Bryant	255
New Trends in Machine-Tool Design—Foreign and Domestic, F. S. Blackall, jr.	259
Editorial	225
Briefing the Record	264
European Survey	276
ASME Technical Digest	278
Contents of ASME Transactions	288
Comments on Papers	289
Reviews of Books	294
ASME Boiler Code	296
ASME News	298
ASME Junior Forum	308
Engineering Societies Personnel Service	310

OPPORTUNITY ADVERTISEMENTS

If you desire capital or have it to invest; if you have a patent for sale or development; if you have on hand used machinery for disposal, or if you want such equipment; if you have copies of publications or a set of drawing instruments to dispose of; if you need help or want a position; in fact, anything to be offered that somebody else may want or anything wanted that somebody else may have—use a classified advertisement in the Opportunities Section.

RATES

Classified advertisements under this heading in MECHANICAL ENGINEERING are inserted at the rate of $1.70 a line, $1.35 a line to members of ASME. Seven words to the line average. A box number address counts as one line. Minimum insertion charge, 5 line basis. Display matter carried in single column units of multiples of one inch at the flat rate of $28 per inch per insertion. Copy must reach us not later than the 10th of the month preceding date of publication.

The American Society of Mechanical Engineers
29 West 39th Street New York 18, N. Y.

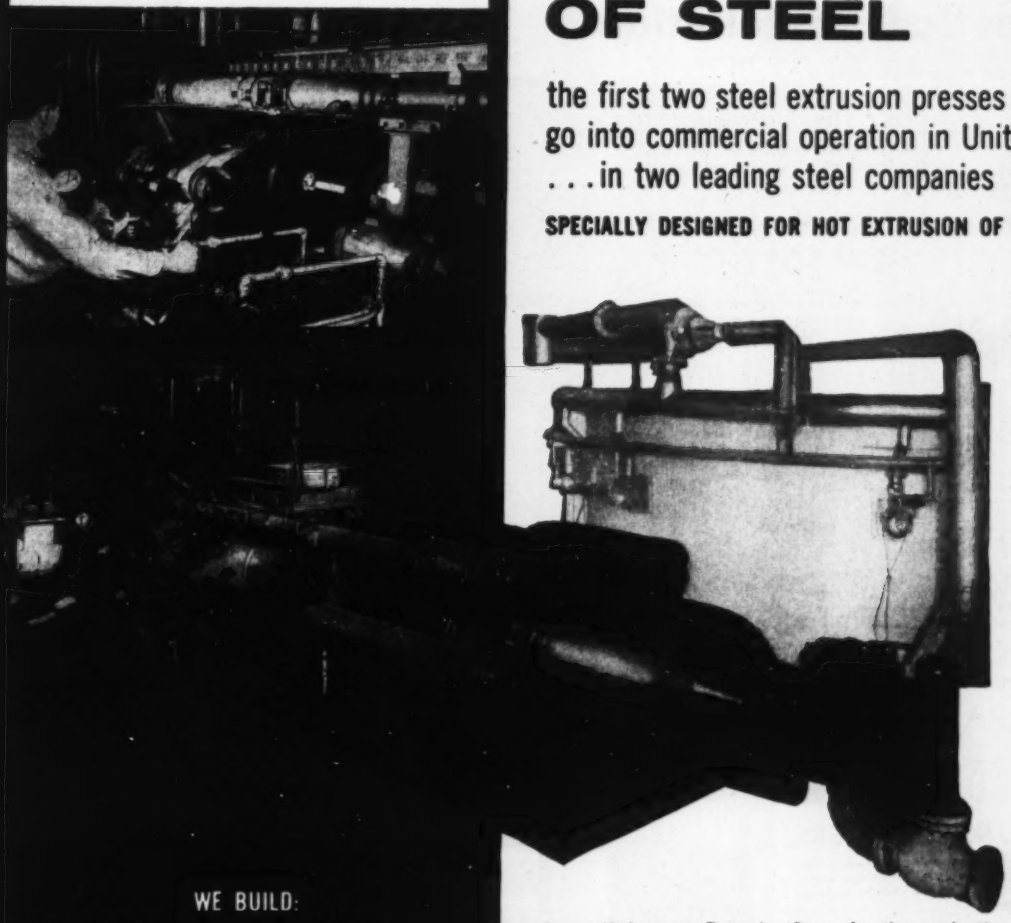
LOEWY-HYDROPRESS

FIRST

IN EXTRUSION OF STEEL

the first two steel extrusion presses ever to go into commercial operation in United States . . . in two leading steel companies

SPECIALLY DESIGNED FOR HOT EXTRUSION OF STEEL



Loewy-Hydropress Extrusion Press for the production of seamless tubing and shapes from stainless steel and special alloys. Installed at the Beaver Falls, Pa. plant of the Tubular Products Division of The Babcock & Wilcox Co.

WE BUILD:

Extrusion Plants for Steel and Non-Ferrous Metals . . . Open and Closed Die Forging Plants . . . Deep Drawing Single and Double Acting Presses . . . High Pressure Pipe Testing and Expanding Machines . . . Hot and Cold Rolling Mills for Steel and Non-Ferrous Metals . . . Stretching and Detwisting Machines for Extruded Shapes and Sections . . . Sheet and Plate Stretching-Leveling-Machines . . . Maxform High Pressure Rubber Forming Presses

Your Future Inquiries Are Invited

LOEWY HYDROPRESS INC

ENGINEERS • CONTRACTORS

350-M Fifth Avenue, NEW YORK 1, N. Y.

Rolling Mills • Hydraulic Presses • Pipe Testing Machines • Special Pipe Mill Equipment • Accumulators • Pumps

Birmingham • Chicago • Cleveland • Detroit • Los Angeles • Phoenix • San Francisco • Seattle • Washington, D. C. • Wheeling • Genoa, Italy • London, England • Madrid, Spain • Paris, France • Philippine Islands

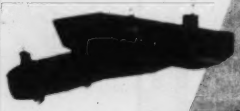
SYNTRON EQUIPMENT

Provides The Logical Answer

for Efficient Practical Installation

ELECTRIC VIBRATORS

Insure a positive, free flow of materials through bins, hoppers and chutes. Compact—electro-magnetic—variable controlled.



VIBRATORY FEEDERS

For complete feeding control of bulk materials—fine powders or heavy lumps. Capacities from a few pounds to hundreds of tons per hour.

SHAFT SEALS

Mechanical, pressure balanced seals for positive sealing of gases and liquids. Self-lubricating, extremely long life.

PARTS FEEDERS

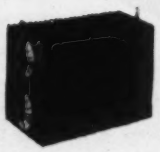
Ideal for automation set-ups. Feed small parts single file—to oriented position—automatically—at controllable rates.

INFRA-RED HEATING PANELS

They heat by direct radiation—not by reflection. Radiate flat, even heat pattern with no blind spots.

SELENIUM RECTIFIERS

Efficient, low-cost, almost unlimited life. For industrial dc power conversion applications. From 1 ampere cells to huge air cooled stacks.



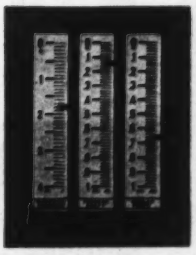
Throughout a wide range of industrial installations, Syntron Equipment continues to reduce production costs. Its extremely low maintenance and rugged dependability make it the natural choice for many automatic processing installations.

This complete miniature catalogue, illustrating and briefly describing Syntron Equipment will be sent Free - upon request.

SYNTRON COMPANY
498 Lexington Avenue Homer City, Penna.

EASIER TO *Read*

Beside the foolproof, precision mechanism which insures utmost accuracy in ELLISON Draft Gages, they are easier to read—both the Straight-Line and Dial type gages. Scales are of translucent glass with distinct black graduations printed on the glass by special process. Accurate readings from any viewpoint.



With engineers who want freedom from gage worries it's ELLISON. Bulletin 122 describes Straight-Line and Dial Bell Gages —Bulletin 124 for Straight-Line Diafram Gages.

ELLISON DRAFT GAGE CO.
552 W. MONROE ST. Since 1896 CHICAGO 6, ILL.

THE ELLISON LINE ALSO INCLUDES:

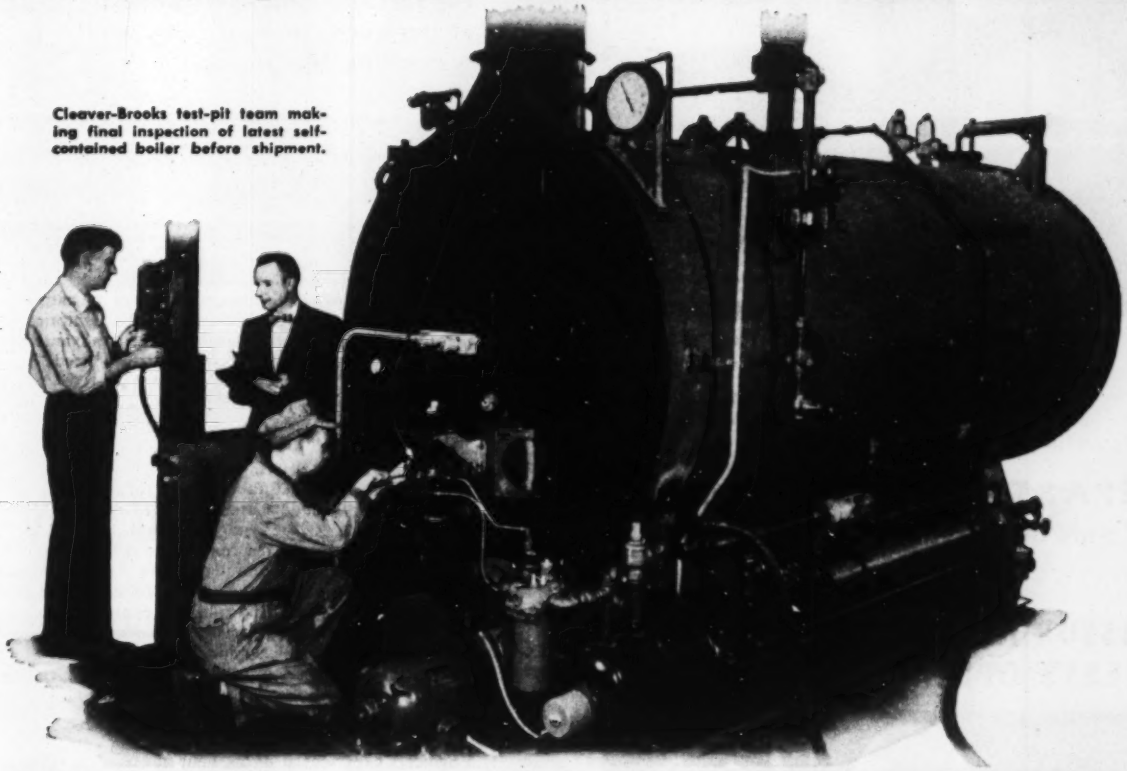
Draft Gages, Bell and Diafram—Inclined Draft Gages—Portable Inclined Vertical Tube Gages—Vertical Tube Gages—Oil, Heavy Liquid and Mercury—Single and Multi-Tube-Saturator Gages—U Gages—Stationary and Portable—Air Filter Gages—Dial and Inclined Tube Types—Pitot Tubes—U Path Steam Calorimeters—Portable Gas Analyzers-Orsat Type

On liquid, gas or dry-material lines, DeZurik Valves with rubber-faced plugs offer exclusive advantages. They open or close with an e-a-s-y quarter-turn, without binding or sticking; they require no lubrication—almost no maintenance! They're available in sizes from ½" to 20", in a full range of metals, lever, gear or remote operation. Write for recommendations.

DeZURIK SHOWER CO. Sartell Minnesota

their counterpart "Test-Pilots" have at Cleaver-Brooks

Cleaver-Brooks test-pit team making final inspection of latest self-contained boiler before shipment.



HIGH SCORES . . . on factory and on-job tests guarantee greatest return from boiler investment

When test pilots give the familiar "O.K." — that's the sign of proven performance. It's the same with boilers in the Cleaver-Brooks plant. Only after accurate, thorough inspection and testing under actual operating conditions do boilers get the final "O.K." from experienced test engineers. That's why you get guaranteed 80% efficiency from your Cleaver-Brooks boiler when firing with oil.

A record of this test is available to every buyer on request. In fact, you as a buyer, consultant, or contractor are invited to witness the actual test on your Cleaver-Brooks boiler before shipment.

And further, Cleaver-Brooks boilers are placed in operation at the job site by factory service engineers who check installation, train your operators and make complete and detailed field tests.

So, when you buy a boiler, insist on factory tests as well as field service tests by qualified engineers. There is no better way of insuring yourself of the very best value money can buy and the greatest return from your boiler investment. Look to Cleaver-Brooks, the leader in the "Packaged" Boiler field for two decades. Write today for latest Catalog AD-100.

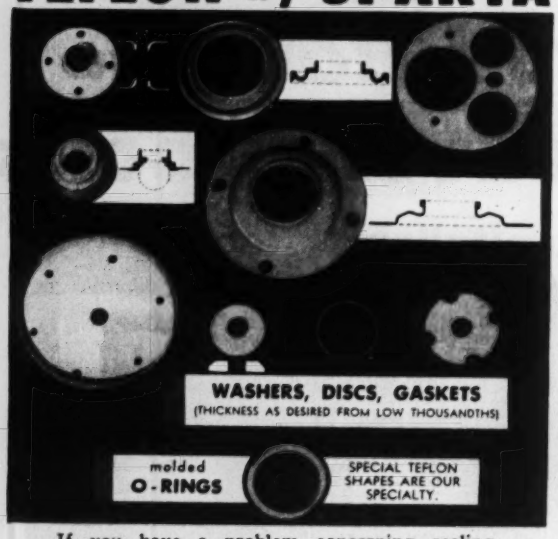
Available for oil, gas and combination oil/gas firing.

CLEAVER-BROOKS COMPANY
Dept. D-318 E. Keefe Ave.
Milwaukee 12, Wisconsin, U.S.A.

Cleaver-Brooks
Originators of the Self-Contained Boiler

BOILERS — STEAM OR HOT WATER — FOR HEATING AND PROCESSING IN SIZES FROM 15 TO 500 HP, 15 TO 250 PSI

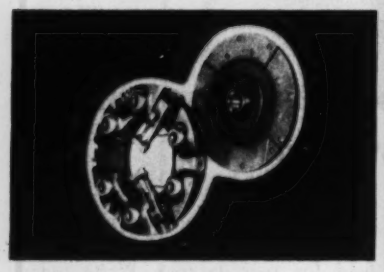
TEFLON by SPARTA



If you have a problem concerning sealing, non-friction, non-adhesion, chemical inertness, temperature, electrical or other . . . that one or more of the remarkable combinations of properties of TEFLON can help you solve, let us try to help.

SPARTA MANUFACTURING
Company • EAST SPARTA, OHIO

ASSURING SMOOTH EASY OPERATION



ROCKFORD CLUTCHES are carefully adjusted and accurately balanced to prevent drag or centrifugal force from affecting their smooth running operation. An electronic gauge checks the balance of each ROCKFORD CLUTCH, within extremely close limits, before it passes final inspection.

SEND FOR THIS HANDY POWER TRANSMISSION BULLETIN
It shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications. Every development engineer will find help in this handy bulletin, when planning new or improved products.

ROCKFORD CLUTCH DIVISION
Borg-Warner Corporation
1307 Eighteenth Avenue, Rockford, Illinois

ROCKFORD CLUTCHES

ELECTRO | MECHANICAL

Engineers

For research and development of electromechanical radar and computing equipment.

Significant advancements in the fields of airborne radar and fire control systems are requiring further applications of electromechanical techniques in the Hughes Radar Laboratory.

The company

Hughes Research and Development Laboratories, located in Southern California, form one of the nation's leading electronics organizations. The Laboratories are presently engaged in the development of advanced electronic systems and devices which are produced by the Hughes manufacturing divisions.

Areas of work

The work calls for devising reliable, maintainable, manufacturable designs for precision equipment developed in the Hughes Radar Laboratory. The equipment consists of mechanical, electronic and microwave devices and systems to be manufactured in quantity. The equipment designs require the use of such advanced techniques as subminiaturization, unitized "plug-in" construction, with emphasis on design for volume production. Knowledge of electronic components, materials, finishes and specifications is useful.

The future

Engineers experienced in the field of electromechanical design for production or those interested in entering this field will find outlets for their abilities and imagination in these activity areas. New electromechanical techniques are opening new applications for airborne electronic equipment. Hughes engineers will have the full benefit of working experience in these fundamental developments.

Assurance is required that relocation of the applicant will not cause the disruption of an urgent military project.

Address resume to **Scientific and Engineering Staff**

Hughes

Research and Development Laboratories

Culver City, Los Angeles County, California

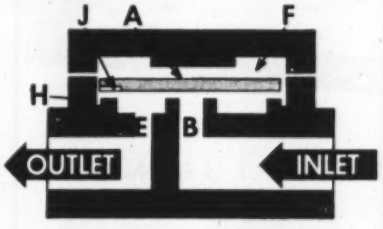
SARCO
Thermodynamic
STEAM TRAP

ACTUAL SIZE

this new trap virtually eliminates maintenance

SOLID STAINLESS STEEL DISC ACTS AS VALVE HEAD

HERE'S HOW IT WORKS!



Air and or condensate raise valve seat disc A, discharge thru E. When steam follows, greater velocity causes it to strike body at H thus building up pressure in chamber F. This causes disc to seat, closing tube B. As pressure in F decreases by condensation and leakage thru slot J, pressure in tube B raises disc and cycle is repeated.

The Sarco Thermodynamic Trap has proved successful on steam mains and separators; headers and soot blower pipes; engine and turbine stop valves, separators and casing drains; alternate heating and cooling applications.

A solid stainless steel disc—practically indestructible—is the only moving part!

Most striking feature of the Sarco *Thermodynamic* Trap is its simple maintenance-free design. There's only one moving part – a solid stainless steel disc that practically lasts forever. There are no other moving parts to wear out or cause trouble.

Condensate, air and steam act directly on the disc valve which opens to discharge condensate and air – snaps shut to contain steam. There are no mechanical devices required to operate valve (see diagram at left). That means practically endless trouble-free operation.

Other advantages: small size, easy installation, not affected by shock or vibration, immunity to corrosive elements with all wearing parts stainless steel, same valve head and seat for all pressures to 600 psi and temperatures to 950° F.

Check these advantages to your own satisfaction at absolutely no cost. We'll send you a trap for free trial. All you do is fill out the coupon and mail it in.

SARCO COMPANY, Inc.
Empire State Building, New York 1, N. Y.

MAIL COUPON TODAY FOR FREE TRIAL

Sarco Company, Inc., Empire State Bldg., New York 1, N.Y.
Gentlemen: Please send me a Sarco Thermodynamic Trap for 30-day trial, requirements as checked.
Size: ½"... ¾"... 1"... Operating Pressure:.....psi

For installation on.....

NAME_____

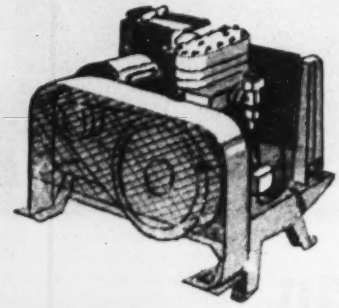
FIRM_____

ADDRESS_____

CITY_____ STATE_____

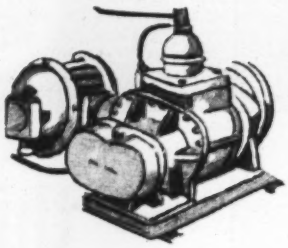
FROM *the Bundy Sketchbook*
TO *jog a designer's imagination*

COMPRESSOR LINES

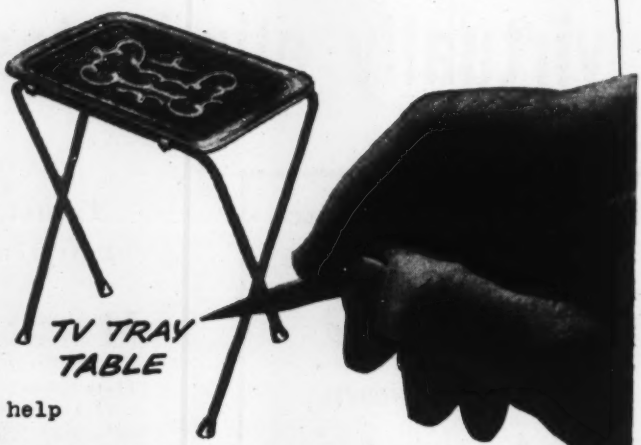


SERPENTINE COILS IN CONDENSER UNIT

VACUUM PUMP LINES



REMARKS Is that cost-saving idea wasting away in a notebook? Then why not let expert Bundy engineers help bridge the gap between idea and finished product. They offer you specialized engineering skills, unmatched fabrication facilities, plus the priceless extra of Bundyweld, the only tubing double-walled from a single strip (see below).



TV TRAY TABLE

WRITE today for catalog for help in developing your tubing ideas.

BUNDY TUBING COMPANY, DETROIT 14, MICH.

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of copper-coated steel. Then it's . .

continuously rolled twice around laterally into a tube of uniform thickness,

and passed through a furnace. Copper coating fuses with steel. Result . . .

Bundyweld, double-walled and brazed through 360° of wall contact.

BUNDYWELD TUBING®

DOUBLE-WALLED FROM A SINGLE STRIP

Leakproof
High thermal conductivity
High bursting point
High endurance limit
Extra-strong
Shock-resistant
Ductile
Lightweight
Machines easily
Takes plastic coating
Takes plating
Bright and clean
No inside bead
Uniform I.D., O.D.

Bundy Tubing Distributors and Representatives: *Bridgeport, Conn.:* Korhumel Steel & Aluminum Co., 117 E. Washington St. • *Cambridge 42, Mass.:* Austin-Hastings Co., Inc., 226 Binney St. *Chattanooga 2, Tenn.:* Peirson-Deakins Co., 823-824 Chattanooga Bank Bldg. • *Chicago 32, Ill.:* Lapham-Hickey Co., 3333 W. 47th Place • *Elizabeth, New Jersey:* A. B. Murray Co., Inc., Post Office Box 476 • *Los Angeles 58, Calif.,* Tubesales, 5400 Alcoa Ave. • *Philadelphia 3, Penn.:* Rutan & Co., 1717 Sansom St. • *San Francisco 10, Calif.:* Pacific Metals Co., Ltd., 3100 19th St. • *Seattle 4, Wash.:* Eagle Metals Co., 4755 First Ave., South • *Toronto 5, Ontario, Canada:* Alloy Metal Sales, Ltd., 181 Fleet St., W.
Bundyweld nickel and Monel tubing are sold by distributors of nickel and nickel alloys in principal cities.

Representatives—Sales Agencies
Business For Sale
Partnership—Capital
Manufacturing Facilities

OPPORTUNITIES

Positions Open—Positions Wanted—Equipment, Material, Patents, Books, Instruments, etc. Wanted and For Sale

Answers to Box number advertisements should be addressed to given box number, care of "Mechanical Engineering," 29 West 39th St., New York 18, N. Y.

POSITIONS OPEN

DESIGN ENGINEER

Graduate Engineer with 8-10 years' experience. Must be capable of initiating original designs in mechanical linkage for reciprocating pump drives.

We are a young, aggressive, employee owned, and leading manufacturer of Controlled Volume Pumps.

EMPLOYEE BENEFITS

Excellent Growth Opportunities
Suburban Location
Profit Sharing
Retirement Savings Plan
Many others

Send Resumé including Patent Numbers and Salary desired to

MILTON ROY COMPANY
1300 E. MERMAID LANE
PHILADELPHIA 18, PA.

PROJECT MANAGER

Permanent position on our engineering staff for a mechanical or chemical engineering graduate with 8-10 years' experience in petroleum refinery, petro-chemical or chemical plant design and development. Ours is an East Coast organization known the world over for accomplishments in these fields.

This position requires the capacity to assume immediate and complete responsibility for the coordination of the activities involved in this endeavor. There is considerable customer and vendor contact.

Our salary offer is high, and in addition we have a liberal pension plan, an accumulative vacation policy, executive insurance and many other employee benefits. We will assume the expense incurred by traveling and moving to this area.

Please write details of experience, education, salaries received and initial salary requirements. Complete privacy is guaranteed. Our personnel know of this opening.

Box 310, Room 1201
230 West 41 St., New York 36

RATES Classified Advertisements under this heading in MECHANICAL ENGINEERING are inserted at the rate of $1.70 a line. $1.35 a line to members of ASME. Seven words to the line average. A box number address counts as one line. Minimum insertion charge, 5 line basis. Display Advertisements carried in single column units of multiples of one inch at flat rate of $28 per inch per insertion. Copy must reach us not later than the 10th of the month preceding date of publication.

Editorial Assistant

—of long-established technical magazine in the field of general mechanical engineering. Must be graduate of engineering school with practical engineering and editorial experience. Under 30 years of age, with ability to do original writing, rewriting, and abstracting, reporting and interviewing, and willing to travel. Location New York. Permanent position. Apply by letter with photograph, record of school and engineering work, references and salary expected.

Address CA-4596, % "Mechanical Engineering."

For
MISSILE PROPULSION SYSTEMS
we need
MECHANICAL DESIGNERS
STRESS ANALYSTS
VIBRATION ANALYSTS
DESIGN DRAFTSMEN

A background in gas turbines is particularly desirable.

For
GUN DEVELOPMENT
we need
RESEARCH ENGINEERS

with extensive experience in interior ballistics and ordnance design at the Project Engineer level.

This is an OPPORTUNITY

for personal growth with a rapidly expanding company under attractive working conditions and unusually liberal employee benefits. All inquiries will be treated confidentially.

EXPERIMENT INCORPORATED
Richmond 2, Virginia

TECHNICAL PERSONNEL

looking for opportunities in

ATOMIC ENERGY

ENGINEERS
- CORROSION
- MACHINE DESIGN
- ELECTRICAL POWER DESIGN
- HEATING AND VENTILATING
- PROCESS INSTRUMENTATION DESIGN
- CONSTRUCTION DESIGN AND LIAISON
- PRESSURE VESSEL AND EQUIPMENT INSPECTION
- PROCESS ANALYSIS—MATHEMATICAL AND STATISTICAL
- CHEMICAL ENGINEERING DESIGN, RESEARCH, DEVELOPMENT, PRODUCTION

MATHEMATICIANS AND STATISTICIANS
- ENGINEERING OR PHYSICAL SCIENCE BACKGROUND DESIRABLE

METALLURGISTS
- PHYSICAL AND PROCESS

CHEMIST
- ANALYTICAL, CORROSION, QUALITY CONTROL, RESEARCH AND TROUBLE SHOOTING

Qualified graduates with 0–8 years' experience
Send resumé and salary information to

TECHNICAL PERSONNEL OFFICE

CARBIDE AND CARBON CHEMICALS COMPANY
a division of
UNION CARBIDE AND CARBON CORPORATION
POST OFFICE BOX P, OAK RIDGE, TENNESSEE

Four Pages of "OPPORTUNITIES"

ENGINEERS

The APPLIED PHYSICS LABORATORY OF THE JOHNS HOPKINS UNIVERSITY offers an exceptional opportunity for professional advancement in a well-established laboratory with a reputation for the encouragement of individual responsibility and self-direction. Our program of

GUIDED MISSILE RESEARCH AND DEVELOPMENT

provides such an opportunity for men qualified in:

MECHANICAL DESIGN AND FOLLOW-UP
PACKAGING OF ELECTRONIC COMPONENTS
STRUCTURAL ANALYSIS
TEST PROCEDURES AND INSTRUMENTATION
SERVOMECHANISMS
MISSILE SYSTEMS DEVELOPMENT

Please send your resumé to:

John J. Long

APPLIED PHYSICS LABORATORY

THE JOHNS HOPKINS UNIVERSITY

8621 Georgia Avenue
Silver Spring, Maryland

MECHANICAL ENGINEERS

Career opportunities exist in suburban Buffalo, New York, in the following capacities:

RESEARCH
DESIGN
DEVELOPMENT

Problems relating to production and distribution of industrial gases; synthetic crystal fabrication; synthetic lubricants; flame plating; welding and other related work.

Men with 0 to 5 years' experience desired. Please submit complete resumé including salary requirements to:

TECHNICAL PERSONNEL DEPARTMENT

LINDE AIR PRODUCTS CO.

A Division of

UNION CARBIDE & CARBON CORP.
E. PARK DR. & WOODWARD AVE.
TONAWANDA, N. Y.

GRADUATE ENGINEERS

Nationally known east coast combustion equipment manufacturer has permanent openings for men familiar with design and operation of large stoker-fired boilers and controls. Excellent opportunity for engineers with vision, energy, and ambition. Replies confidential.

Address CA-4639, % "Mechanical Engineering."

Additional Opportunities are offered in the display advertisements— on pages 48, 56, 64, 76 and 138

MAKE USE OF THE OPPORTUNITIES SECTION

If you desire capital or have it to invest; if you have a patent for sale or development; if you have on hand used machinery for disposal, or if you want such equipment; if you have copies of publications, or a set of drawing instruments to dispose of; if you need help or want a position, in fact anything to be offered that somebody else may want, or anything wanted that somebody else may have—use a classified advertisement in MECHANICAL ENGINEERING for quick results.

Here are 5 reasons why you will want to come with us if you are a . . .

mechanical engineer

mechanical designer

electrical engineer

physicist

metallurgist

1. You can get in "on the ground floor" in the field of electronic computers and associated equipment for use in business machines. This means excellent opportunity for advancement.
2. You can plan your future with a long-established, highly successful Company.
3. You will receive a good salary, plus substantial "fringe" benefits.
4. You and your family will enjoy Dayton . . . a clean, progressive city with outstanding school facilities.
5. You will find NCR a friendly place to work, with employee morale at a high level.

Act at once. Write today to Employment Manager, Department C, describing your education and experience.

THE NATIONAL CASH REGISTER COMPANY, Dayton 9, Ohio

Keep your in-plant traffic accidents to a minimum by enforcing the recommendations of the

SAFETY CODE FOR INDUSTRIAL POWER TRUCKS

This Code covers the construction and design features of the driver-ride and driver-lead industrial power trucks, accident prevention guards and guarding devices, and use of mechanized equipment in hazardous locations. It provides general safety regulations for trucks and it supplies 35 safety rules for truck operators.

(B56.1—1950) 85¢. 29% discount to ASME members.

If purchased in quantities:

$17.00 for 25 copies
$31.87 for 50 "
$59.50 for 100 "

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

29 W. 39th Street New York 18, N. Y.

MACHINE DESIGN ENGINEER

One of our clients requires the services of a Development Engineer to supervise the redesign of existing products and to assist in the creation of new products. Work may also include design of necessary tooling. This is a fine opportunity for a permanent and challenging position.

This Machine Design Development Engineer must have a high college scholastic record, be between 25 and 40 years of age, and be able to take responsibility. He must be willing to do board work himself and direct the work of one or two assistants. Experience in automatic machinery, machine tools, gear reducers, weldments, conveying equipment is desirable but not absolutely necessary. Some knowledge of patents is also desirable. Salary. Location—Midwest. Write:

Charles T. Freeman Advertising Agency
19 Beechwood Avenue
Springfield 8, Massachusetts

Engineers

mechanical • electrical • aeronautical

The Aircraft Nuclear Propulsion Department of the General Electric Company, now engaged in the design and development of a propulsion system for nuclear aircraft, offers far-reaching opportunities in this great new field.

Positions are open for engineers with experience in the following:

MECHANICAL DESIGN **AERODYNAMICS**
THERMODYNAMICS
STRUCTURAL DESIGN AND ANALYSIS

Bachelors or advanced degrees in Mechanical, Electrical, or Aeronautical Engineering with experience in design, development or testing.

Please send resume to: Department 0-6, Technical Personnel

GENERAL ELECTRIC

Aircraft Nuclear Propulsion Department *Atomic Products Division*
P.O. BOX 132 CINCINNATI 15, OHIO

Four Pages of "OPPORTUNITIES"

POSITIONS OPEN

Continued from Page 143

RESEARCH & DEVELOPMENT ENGINEER

Mechanical or chemical, experienced in mechanical aspects of process industry equipment. Will carry out laboratory research to develop improved mechanical equipment for use in petroleum refining. Prefer graduate level training in heat transfer, fluid flow and thermodynamics. Age 30–40. New laboratory building, excellent facilities. Major oil company in Chicago area. Reply giving details of training and experience.

Address CA-4649, % "Mechanical Engineering."

Large industrial instrument manufacturer has openings in Boston, Chicago, Philadelphia, Detroit and New York for SALES ENGINEERS. Engineering graduates between 25 and 30 years of age preferred. Also has opening in Application Engineering Department for experienced instrument Engineer with chemical engineering background and minimum several years' recent experience in application of instruments in chemical or petroleum processing industries. Position requires man with initiative and sales aptitudes. Location: New England. Address CA-4628, care of "Mechanical Engineering."

MECHANICAL ENGINEER—with at least ten years' experience in the operation and maintenance of refrigeration equipment and air handling equipment for position as Building Engineer to operate "Heat pump" system in largest office building in New Mexico. College graduate preferable but not essential. In reply give full details regarding experience, education and salary expected. Savage & Sganzini, 215 Fourth St., S.W., Albuquerque, N. M.

PROFESSOR IN CIVIL ENGINEERING—Duties involve teaching of such courses as structural design in concrete, steel, and timber and mechanics of materials. Desire registered professional engineer associated with A.S.C.E. Salary and academic rank open depending on degree and experience. Position starts September, 1954. Location, Ohio. Address CA-4635, care of "Mechanical Engineering."

PROFESSOR IN CIVIL ENGINEERING—Such courses as surveying, soil and fluid mechanics, statics, and highways are to be taught. Registered (or willing to do so) professional engineer desired. Degree and experience to determine academic rank and salary. Position starts September, 1954. Location, Ohio. Address CA-4636, care of "Mechanical Engineering."

PROFESSOR IN MECHANICAL ENGINEERING—Courses in mechanical drawing and the heat field are to be taught. Professional engineer desired. Experience and degree will determine salary and academic rank. Position starts September, 1954. Location, Ohio. Address CA-4637 care of "Mechanical Engineering."

MECHANICAL DESIGN ENGINEERS—for plant layout and automatic machine design. Positions entail wide range of engineering work, some electrical. Experience in pulp, paper or wallboard plants desirable but not necessary. Reply giving complete details of experience and training. Opportunities for advancement. Salary to start $5,000–$7,000 depending on age and experience. Location South. Address CA-4638, care of "Mechanical Engineering."

Openings in Guided Missile and Rocket Development Program. Need qualified personnel in the fields of engineering, mathematics, physics, chemistry, ballistics. Opportunity for self expression and extension of present scientific knowledge. Write or send application on Standard Form 57, which can be obtained at your Post Office, to Commanding General, Redstone Arsenal, Huntsville, Alabama. Attn: Luther Adams, Civilian Personnel Division.

ASSISTANT TO MANAGER—The Trane Company, a leading manufacturer of air conditioning, heating, ventilating and heat transfer equipment, has unusual opening for young graduate engineer. Applicant must have interest in heat transfer engineering and sales management *plus* 2 to 5 years' experience in aircraft systems or components of systems. Excellent opportunity to advance with growing concern. Submit resumé to: The Trane Company, La Crosse, Wisconsin, Attn: D. B. Reed.

ENGINEERS—College positions. All sections U.S. all fields of engineering. Openings for B.S., M.S. and PhD's. Excellent salaries. Send pictures and qualifications to Cline Teachers Agency, Box 607, East Lansing, Mich.

PRODUCTION TRAINEE—Progressive Chicago Manufacturing Company has an opening for man 25 to 30, with degree in mechanical or chemical engineering or chemistry to train for a position in production management. We want a capable man with a proven record of leadership and accomplishments. Please furnish complete details of your experience and background in first letter. Address CA-4647, care of "Mechanical Engineering."

Large industrial instrument manufacturer has openings for SERVICE ENGINEERS in New York and Philadelphia. Opportunity for advancement to Sales Engineering after two or three years' service. Intensive four months' factory course will be offered. Address CA-4650, care of "Mechanical Engineering."

MECHANICAL ENGINEER—for supervisory position in Maintenance Department of large western Pennsylvania chemical plant. Excellent opportunities for advancement. Three to five years' experience desirable. Reply giving age, education experience, and salary requirement. Address CA-4656, care of "Mechanical Engineering."

Consulting Engineering firm in deep south now entering industrial design and construction field requires ENGINEER with design and organizational ability. Experience required in natural gas, petroleum, petro-chemical and allied fields, or for manufacturing plants. Outline experience briefly. Address—CA-4661, care of "Mechanical Engineering."

POSITIONS WANTED

ENGINEER—BSME, ASME, Age 31. Experienced construction, plant expansion and all phases plant engineering; product development; production methods and standards. Practical machine shop experience. Desires job as chief or plant engineer small company or assistant to top executive. Desired salary $8500. Address CA-4632, care of "Mechanical Engineering."

STEAM POWER PLANT—management of operation in U.S.A. or abroad; thoroughly experienced on coal, oil, and gas fuels, industrial and public utility plants, up to 2,000 pounds pressure, 600,000 KW. Good background on erection and starting new plants; some power line construction. Address CA-4634, care of "Mechanical Engineering."

MECHANICAL ENGINEERING—31, Ph.D., 2 years' machine shop supervising, 4 years' university teaching and research in Materials and Processing, Applied Mechanics, Stress Analysis. Desire research, development or teaching position. Address CA-4640, care of "Mechanical Engineering."

ENGINEER ATTORNEY—desires overseas employment. B.S.-M.E. L.L.B. Reg Eng and Member of the Bar D.C. Eight years' experience includes engineering studies, patent law, negotiation and administration of construction contracts. Address CA-4646, care of "Mechanical Engineering."

MECHANICAL ENGINEER—40, M.M.E., P.E., experienced administrator, product design and development, moderate and heavy fabrication, steel and alloy construction, automatic machines and machine design. Now chief engineer, desire similar responsibilities with greater opportunities. Location, salary open. Address CA-4651, care of "Mechanical Engineering."

MECHANICAL ENGINEER—49, married, Scotch-Irish. Experienced in Steam and Power Field. B.S.M.E. (Industrial Engineering) University of Michigan '28. Registered Prof. Engr. States of Ohio, Louisiana, Alabama. Member—ASME—Instr. Soc. of Amer.—Birmingham Engineering Society—Louisiana Engineering Society. Twenty-five years' experience field contact as Sales Engineer. Desires change to Management, Application Engineer, Liaison with Engineering and field men, Purchasing. Available May 1st. Address CA-4654, care of "Mechanical Engineering."

MECHANICAL ENGINEER—27 BME (Co-Op) completing 3-year tour with Navy in Research and Development as Project Officer on weapon development. Previous experience 4½ years' diversified experience in steel fabrication and power plant operation. Desire position with opportunities for advancement. Salary open. Write LTJG John J. Lemm, U.S. Naval Underwater Ordnance Station, Newport, R.I.

MECHANICAL ENGINEER—29, ME, MS. Six years' experience in power field including two years' sales of heavy equipment on executive level. Desires position leading to management. Will relocate. Address CA-4644, care of "Mechanical Engineering."

MECHANICAL ENGINEER—BSME, 30, married. 1 yr. experience design and operation of induction heat-treating equipment. 5 yrs. in charge of bus and automotive maintainence of small service organization. Thorough working knowledge electronic circuits. Address CA-4659, care of "Mechanical Engineering."

MECHANICAL ENGINEER—B.S., M.S., Registered. 6 years' automotive and aeronautical industry—research and development. 9 years' university-teaching, research, consulting; now associate professor. Available for design or development projects this summer. Location, midwest. Address CA-4660, care of "Mechanical Engineering."

ADMINISTRATIVE ENGINEER—Age 34, married, 2 children, B.S.M.E., Mass. Inst. of Tech., 1942, Tau Beta Pi. Graduate work in math and servo-mechanisms. 11½ years' packaging machinery design, 6½ years in commercial and government instrumentation research, development and management including design and test as well as personnel, patents, contracts, correspondence, sales, etc. Currently doing full time consulting for a company investigating entry into electronics field. Interested in administrative engineering position in electromechanical development and promotion. Address CA-4662, care of "Mechanical Engineering"

REPRESENTATION WANTED

STEAM SPECIALTIES—Sales Representatives in contact with industrial plants using steam specialties of quality wanted by Eastern manufacturer. All territories available, except New York and New Jersey. Address CA-4617, care of "Mechanical Engineering."

EMPLOYMENT AGENCIES AND SERVICE BUREAUS

ENGINEERS AND EXECUTIVES—This confidential service for outstanding men who desire positions paying $5,000 to $40,000 will develop preliminary negotiations with reputable organizations without risk to present position. For complete details, send experience record and expected salary range. Tornsett Associates, 337 Frick Bldg., Pittsburgh 19, Pa.

PLANT PERSONNEL, ENGINEERS, DESIGNERS—Draftsmen, Chemists, and Metallurgists, E. G. Stroud, Member ASME and President of Cleveland Engineering Agency Co., 2132 E. 9th St., Cleveland 15, Ohio, will help you find positions or men.

SALARIED PERSONNEL $3,000—$25,000

This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions, assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited.

JIRA THAYER JENNINGS
Dept. J, 241 Orange Street, New Haven, Conn.

SALARIED POSITIONS $5,000 to $35,000. We offer the original personal employment service (established 44 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars.

R. W. BIXBY, INC.
602 Brisbane Bldg. Buffalo 3, N. Y.

Every Advertiser appearing in MECHANICAL ENGINEERING believes . . . . that his products . . . the service in them and the service behind them . . . will stand up under the most searching scrutiny of the high calibre engineers and executives comprising MECHANICAL ENGINEERING readership.

Handling costs CUT 33% with Link-Belt TRUCK-TOW

Link-Belt conveying systems open huge cost-cutting frontier to industry

LINK-BELT RESEARCH AND ENGINEERING WORKING FOR INDUSTRY

At the busy trucking terminal pictured below, a Link-Belt in-the-floor Truck-Tow Conveyor achieved spectacular savings. Likewise, in factories, terminals and warehouses all over the country, Truck-Tow Conveyors have slashed handling costs. Shipping and receiving . . . department to department . . . in and out of storage. In fact, wherever packaged or bulky items are moved along a regular route by floor trucks—Truck-Tow can provide faster, safer handling. Rehandling is eliminated. Damage, loss, split shipments and errors are minimized.

There may be locations in your plant where conflicting traffic causes confusion . . . where valuable manpower is being wasted in carrying or pushing. If so, a call to your nearby Link-Belt office will put you in touch with a materials handling engineer. He can show you how flexible, low-cost Truck-Tow can save money for you.

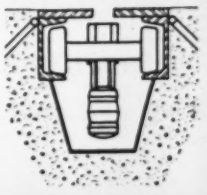
LINK-BELT

13,471

One source . . . one responsibility for materials handling and power transmission machinery

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Repreerentatives Throughout the World.

Scale model (above) of 716-ft. Link-Belt Truck-Tow shows how freight is unloaded from highway trucks on terminal dock's left side—ticketed and moved to assigned local delivery trucks on the right. In the floor and out of the way, this Truck-tow's endless chain moves up to 50 tons of cargo at a time. Floor trucks are easily engaged and disengaged by a pin on the truck that drops into one of the trolley pusher attachments (right) spaced along the chain. Other Truck-Tows operate trucks from overhead conveyors.



RATES One inch Card Announcements inserted at a rate of $20.00 each issue, $15.00 per issue on yearly contract.

CONSULTING SERVICE

Manufacturers of Equipment Not Included

BLACK & VEATCH
CONSULTING ENGINEERS
Electricity—Water—Sewage—Industry
Reports, Design, Supervision of Construction
Investigations, Valuation and Rates
4706 Broadway — Kansas City 2, Missouri

The Kuljian Corporation
ENGINEERS • CONSTRUCTORS • CONSULTANTS
POWER PLANT SPECIALISTS
UTILITY • INDUSTRIAL • CHEMICAL
1200 N. Broad St., Phila. 21, Pa.

SANDERSON & PORTER
ENGINEERS & CONSTRUCTORS
New York • Chicago • San Francisco

Electrical Testing Laboratories, Inc.
Electrical, mechanical, photometric, radiometric and chemical laboratories, rendering testing, research and associated services, including certification, inspections at factories and field investigations.
2 East End Avenue at 79th St., New York 21

PETER F. LOFTUS CORPORATION
Engineering and Architectural Consultants and Designers
First National Bank Bldg.
Pittsburgh 22, Pennsylvania
Cable Address—"LOFTUS Pittsburgh"

Power Plants, Structures
Transmission Systems
Design, Supervision, Inspection
Appraisals, Reports
SARGENT & LUNDY
140 S. Dearborn St., Chicago, Ill.

GILBERT ASSOCIATES, INC.
Engineers • Consultants • Constructors
Reading, Pa.
Engineering and Design
Industrial • Sanitary • Chemical
Economic Research
Industrial Relations
New York • Philadelphia • Washington
Rome • Manila • Medellin

Model Building
Working Models — Miniature
Models — Prototypes — Cutaways
Appearance Models — Mock-ups
write for brochure
MAST DEVELOPMENT CO INC
2212 E 12th St DAVENPORT IOWA

J. E. SIRRINE COMPANY
Engineers
Design and Supervision of Steam and Hydro-Electric Power Plants. Industrial Plants, Mechanical and Operating Surveys, Appraisals • Plans • Reports
Greenville, South Carolina

HARZA ENGINEERING COMPANY
CONSULTING ENGINEERS
E. Montford Fucik — Calvin V. Davis
Richard D. Harza
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development
400 West Madison Street — Chicago 6

WELD TESTING
Qualification of Operators—Supervision
Inspection—Research
NATIONAL WELD TESTING BUREAU
Pittsburgh Testing Laboratory, Pittsburgh, Pa.

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Surveys
Hershey Building — Muscatine, Iowa

C. M. HATHAWAY
CONSULTING ENGINEER
Project Engineering, Product Development, Production Designs, Laboratory and Shop Facilities for Research, Model Work, and Pilot Manufacturing
1315 S. Clarkson Street — Denver 10, Colorado

DELOS M. PALMER & ASSOCIATES
CONSULTING ENGINEERS
Designers of Special Purpose Machines for Fabrication and Assembly Operations
Product Development
Laboratory and Model Work
4401 Jackman Rd. — Toledo 12, Ohio

MECHANICAL - MANAGEMENT - ELECTRONIC
PROCESS - DESIGN - QUALITY - CONTROL
INVESTIGATIONS - APPRAISALS - REPORTS
JOHN I. THOMPSON & COMPANY
ENGINEERS
921-17th ST., NW Washington 6, D. C.
LABORATORY DIVISION BELLEFONTE, PA.

JACKSON & MORELAND
Engineers and Consultants
Utilities and Industrials
Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine design—Technical Publications
BOSTON — NEW YORK

PROPANE GAS PLANTS
and
Anhydrous Ammonia Plants
PEACOCK CORPORATION
Box 268, Westfield, N. J. Westfield 2-6258

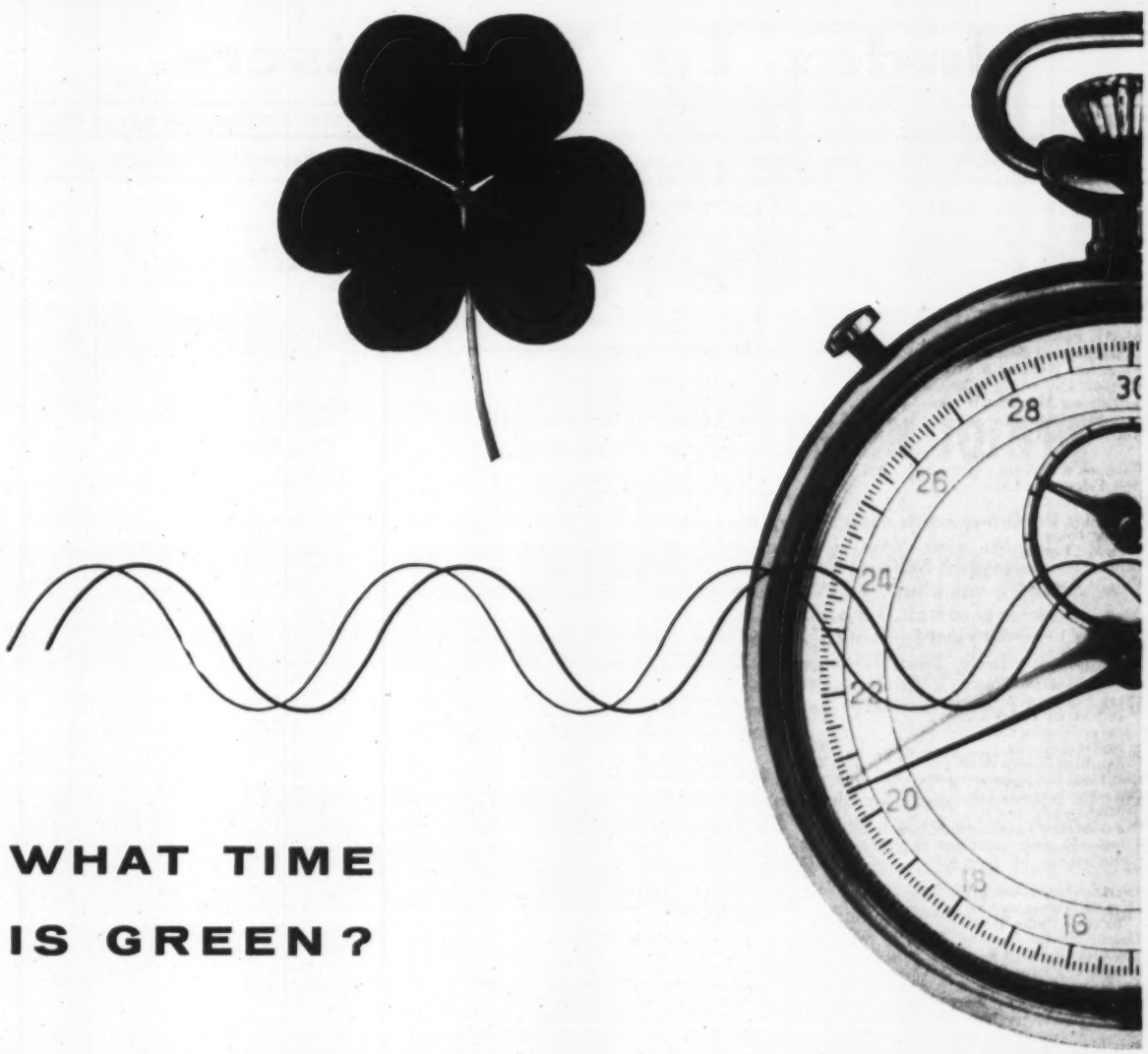
THULIN AND WOODS
Mechanical and Architectural Consultants and Designers
F. A. Thulin, Jr. P. E.—K. R. Woods, P. E.
F. M. Isensee, Arch., P. E.
Safety—Fire Protection Design (including complete test designs for ASTM-E119 tests)—Machine and Product Design and Development—Inspections and Reports—Research on Specific Engineering Problems—Engineering and Architectural Work on Buildings.
105 South LaSalle Street — Chicago 3, Illinois

GEORGE H. KENDALL
Consulting Mechanical Engineers
Methods Studies: Process of Product
Redesign Existing Products for Greater Profit
Trouble Shooting Production, Design, Cost Problems,
Specialist Automatic Machinery Processes, Controls,
New Developments, Patent Studies, Investigations,
New Products & Process Engineering Studies.
P. O. Box 3 (Est. 1923) Tel. Darien 5-1504
Noroton Heights 3 Offices Darien, Connecticut

Consult **Z. H. POLACHEK**
Reg. Patent Attorney
1234 Broadway
(at 31st St.) New York 1, N. Y.
Phone LO 5-3098

E. S. WUERTZ
Consulting Engineers
TECHNICAL GERMAN TRANSLATION SPECIALISTS
Colonia, New Jersey

The above consultants are available
to work out solutions
to your engineering and management problems.



WHAT TIME IS GREEN?

In color television, the colors on the screen are determined in a special way. A reference signal is sent and then the color signals are matched against it. For example, when the second signal is out of step by 50-billionths of a second, the color is green; 130-billionths means blue.

For colors to be true, the timing must be exact. An error of unbelievably small size can throw the entire picture off color. A delay of only a few billionths of a second can make a yellow dress appear green or a pale complexion look red.

To ready the Bell System's television network for color transmission, scientists at Bell Telephone Laboratories developed equipment which measures wave delay to one-billionth of a second. If the waves are off, as they wing their way across the country, they are corrected by equalizers placed at key points on the circuit.

This important contribution to color television is another example of the pioneer work done by Bell Telephone Laboratories to give America the finest communications in the world.

To keep colors true in television, signals must be kept on one of the world's strictest timetables. Equalizers that correct off-schedule waves are put into place at main repeater stations of the transcontinental radio-relay system.

BELL TELEPHONE LABORATORIES

IMPROVING TELEPHONE SERVICE FOR AMERICA PROVIDES CAREERS FOR CREATIVE MEN IN SCIENTIFIC AND TECHNICAL FIELDS.

Index To Advertisers

Your NEW CATALOGS Guide • The Latest Industrial Literature Available • Pages 41-78 inclusive

*Aetna Ball & Roller Bearing Co. 120
*Air Preheater Corp. 133
Allegheny Ludlum Steel Corp. 130
Allen-Bradley Co. 17, 18
*American Blower Corp. 12
*American Brass Co. 23
*American District Steam Co. 149
*American Felt Co. 14
ASME Publications 116
Mechanical Catalog 60
American Welding & Mfg. Co. 99
Amplex, Div. of Chrysler Corp. 85
*Armstrong Machine Works 122
*Associated Spring Corp. 117, 118
Aurora Pump Co. 50

*Babcock & Wilcox Co. 2nd Cover
Bell Telephone Labs. 147
*Blaw-Knox Co.
Grating Dept. 63
Pipe Hangers 47
Power Piping 28
Brush Electronics Co. 13
Bundy Tubing Co. 140

Carborundum Co. 3
Catalytic Combustion Corp. 51
*Chain Belt Co. 25
Chiksan Co. 125
Cincinnati Gear Co. 44
Clark Equipment Co.
Industrial Truck Div. 93
*Cleaver-Brooks Co.
Boiler Div. 137
Columbia-Geneva Steel Co. 101-103
*Combustion Engineering (Inc.) 19
Cone-Drive Gears Div.
Michigan Tool Co. 100
Consolidated Engineering Corp. 89
Coppus Engineering Corp. 95
Cunningham, M. E., Co. 78

*Denison Engineering Co. 126
Detroit Harvester Co.
Pioneer Pump Div. 53
*Detroit Stoker Co. 127
DeZurik Shower Co. 136
Diamond Power Specialty Corp. 31
Dow Corning Corp. 15
*Dresser Industries (Inc.)
Roots-Connersville 57

Eastman Kodak Co. 79
Edward Valves (Inc.)
Sub. Rockwell Mfg. Co. 6
*Elastic Stop Nut Corp. of America 131
Ellison Draft Gage Co. 136
*Engineer Co. 45
Engineered Precision Casting Co. 58

Fairbanks, Morse & Co. 86

*Farrell-Birmingham Co. 129
*Flexitallic Gasket Co. 39
*Flexonics Corp. 111
Ford Instrument Co.
Div. Sperry Corp. 30
*Foxboro Co. 22
Fulton-Sylphon Div.
Robertshaw-Fulton Controls Co. 55

*Garlock Packing Co. 46
General Radio Co. 81
*Goulds Pumps (Inc.) 43
Graphite Metallizing Corp. 70
*Grinnell Co. 80

Hagan Corp. 88, 104
*Hoffman Combustion Engrg. Co. 26, 27
Hyatt Bearings Div., General Motors 97
*Hydropress (Inc.) 135

Imperial Tracing Cloth 134
International Nickel Co. 34
Irving Subway Grating Co. 62

Jenkins Bros. 40
*Johns-Manville 123
Joy Manufacturing Co. 94

Kellogg, M. W., Co. 113
*Kewanee-Ross Corp. 150
Key Co. 107

Lenape Hydraulic Pressing
& Forging Co. 134
*Leslie Co. 114
Lincoln Electric Co. 72
Linear (Inc.) 132
*Link-Belt Co. 145
Little, Arthur D. (Inc.) 92
Lord Manufacturing Co. 37
Lovejoy Flexible Coupling Co. 132
*Lummus Co., Fabricated Piping Div. 52

*Mercoid Corp. 76
Midwest Piping Co. 90
Mycalex Corp. of America 54

Nagle Pumps (Inc.) 75
*National Airoil Burner Co. 71
National Valve & Mfg. Co. 21
New Departure Div., General Motors 1

Nicholson, W. H. & Co. 59
Northern Blower Co. 67

*Pangborn Corp. 68
Parker White-Metal Co. 20
Peerless Photo Products (Inc.) 96
Permutit Co. 3rd Cover
*Petro 32
Philadelphia Gear Works 91
Pittsburgh Lectrodryer Corp. 124
Powell, William, Co. 98
*Powers Regulator Co. 108, 109

*Republic Flow Meters Co. 10
Research Corp. 74
Revere Copper & Brass (Inc.) 7
Robertshaw-Fulton Controls Co. 55
Rockford Clutch Div.
Borg-Warner Corp. 138
*Rockwell Mfg. Co.
Nordstrom Valve Div. 83, 84
*Roots-Connersville Blower Div.
Dresser Industries (Inc.) 57
Rotary Seal Co. 87
Roth Rubber Co. 69

Sanborn Co. 29
*Sarco Co. 139
Sparta Manufacturing Co. 138
Spraying Systems Co. 78
Sturtevant, P. A., Co. 76
*Syntron Co. 136

*Taylor Forge & Pipe Works 2
*Taylor Instrument Cos. 105
Tennessee Coal & Iron Div. 101-103
Terry Steam Turbine Co. 119
Thomas Flexible Coupling Co. 73
Thompson-Bremer & Co. 16
*Timken Roller Bearing Co. 4th Cover
Trabon Engineering Corp. 82
Trane Co. 4, 5
*Tube Turns 65, 66

*United States Steel Corp. 101-103
United States Export Co. 101-103

Vickers (Inc.), Div. Sperry Corp. 33
*Vogt, Henry, Machine Co. 106
*Voss, J. H. H., Co. 132

Waldes Kohinoor (Inc.) 115
Walworth Co. 24
Waterman Engineering Co. 134
*Westinghouse Electric Corp. 49, 128
Wheeler, C. H., Mfg. Co. 121
*Wickes Boiler Co., Div. Wickes Corp. 8, 9
Williams Gauge Co. 61
Wisconsin Motor Corp. 77
Wolverine Tube Div.
Calumet & Hecla (Inc.) 11

*Yarnall-Waring Co. 35
Yoder Co. 112

The asterisk indicates that firm also has product catalog in the 1954 Mechanical Catalog

CONSULTING SERVICE . . . Page 146

Black & Veatch
Electrical Testing Laboratories
Gilbert Associates, Inc.
Harza Engineering Co.
Hathaway, C. M.
Jackson & Moreland
Kendall, George H.
Kuljian Corp.
Loftus, Peter F., Corp.
Mast Development Co.
National Weld Testing Bureau
Palmer, Delos M. & Assoc.
Peacock Corp.
Polachek, Z. H.
Sanderson & Porter
Sargent & Lundy
Sirrine, J. E., Co.
Stanley Engineering Co.
Thompson, John I. & Co.
Thulin & Woods
Wuerts, E. S.

Advertisers in Previous 1954 issues but not in this issue

Aero Research Instrument Co.
*Aldrich Pump Co.
All American Tool & Mfg. Co.
*Allis-Chalmers Mfg. Co.
American Flexible Coupling Co.
*American Manganese Bronze Co.
American Pencil Co.
*American Pulverizer Co.
Anderson, V. D., Co.

*Bailey Meter Co.
*Barco Manufacturing Co.
Barksdale Valves
Bellows Co.
Biddle, James G. Co.
Bigelow-Liptak Corp.
Boston Gear Works
Bruning, Charles, Co.
Byers, A. M., Co.

Carboloy Dept. of
General Electric Co.
Chace, W. M., Co.
Chapman Valve Mfg. Co.
Clarage Fan Co.
*Cochrane Corp.
*Coffin, J. S., Jr., Co.
*Consolidated Chimney Co.
Cupo Engineering Co.

Diamond Chain Co., Inc.
*Downingtown Iron Works
Drop Forging Association
Dudek & Bock Spring Mfg. Co.
DuMont, Allen B., Labs.

*Erie City Iron Works

Fafnir Bearing Co.
*Falk Corp.
Fenwal (Inc.)
Fiske Bros. Refining Co.
Lubriplate Div.
*Foote Bros. Gear & Machine Corp.

*Gear Specialties (Inc.)
General Electric Co.
Gerotor May Corp.

Hamilton Mfg. Co.
Helicoid Gage Div.
American Chain & Cable
Higgins Ink Co.

*Illinois Gear & Machine Co.
International Correspondence Schools
Iron Fireman Mfg. Co.

*James, D. O., Gear Mfg. Co.
Johnson, Carlyle, Machine Co.

Kennametal (Inc.)
Keuffel & Esser Co.
*Koppers Co.
Fast's Coupling Dept.

*Ladish Co.
Lefax
Lubriplate Div.
Fiske Bros. Refining Co.
Lunkenheimer Co.

MB Manufacturing Co.
*Martin-Rockwell Corp.
Marsh Instrument Co.
Morse Chain Co.

National Acme Co.
New York Air Brake Co.
Niagara Blower Co.
Nugent, Wm. W. & Co.

Ohio Gear Co.
Ohio Injector Co.
*Pilgrar Co.
Olson, Arthur & Co.
O'Neil-Irwin Mfg. Co.

Pacific Pumps (Inc.)
*Pennsylvania Pump & Compressor Co.
Pittsburgh Piping & Equipment Co.
*Posey Iron Works

Read Standard Corp.
Reliance Electric & Engrg. Co.
Reliance Gauge Column Co.
Resolite Corp.
Ric-Wil Co.
Ronald Press Co.
Rust-Oleum Corp.

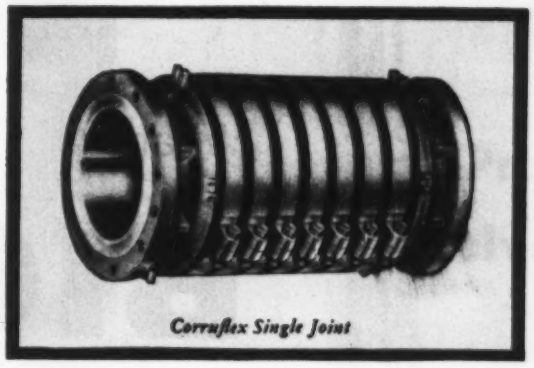
*Schutte & Koerting Co.
*Seamless Co.
Servel (Inc.)
Sheffield Corp.
*Spence Engineering Co.
*Struthers Wells Corp.
Synchro-Start Products (Inc.)
Trimount Instrument Co.

*Western Gear Works
*Westinghouse Air Brake Co.
Wiegand, Edwin L., Co.
*Wing, L. J., Mfg. Co.
Winsmith, (Inc.)
Winseler Mfg. & Tool, Co.

*Zallea Brothers
Zurn, J. A., Mfg. Co.

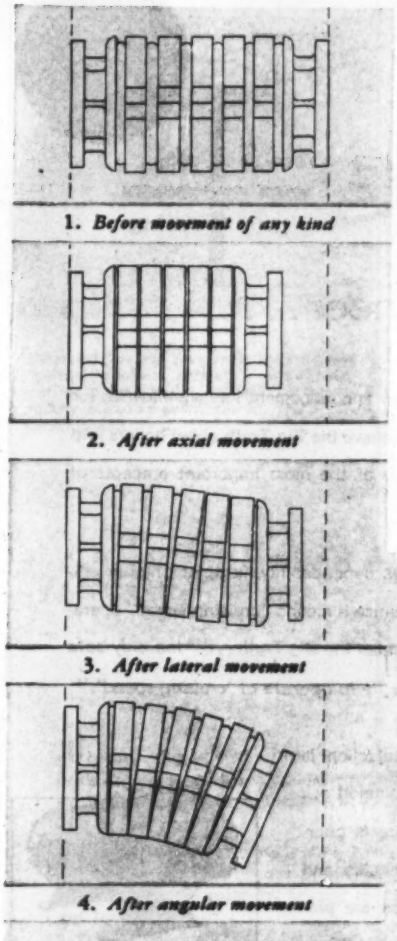
INSTALL...

AND THEN FORGET



Corruflex Single Joint

Corruflex PACKLESS EXPANSION JOINTS



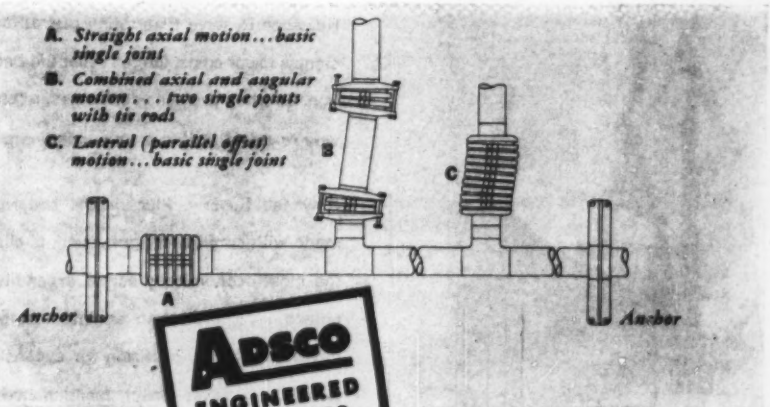
1. *Before movement of any kind*
2. *After axial movement*
3. *After lateral movement*
4. *After angular movement*

Why worry about maintenance in pipe lines when you don't have to? Install ADSCO Corruflex Expansion Joints... they are packless and require no maintenance. Put 'em in the line and forget 'em.

In ADSCO's *complete* Corruflex line there are many joints for many purposes: Swing, Hinge, Tie-Rod, Universal, Internally-Guided, Anti-Compression, Balanced, Gimbal, etc. But the leader of the Corruflex line.. the joint from which all others are derived...is the Basic Single Joint shown on this page. Here is a dependable workhorse which will solve many pipe expansion problems. Problems *it* can't solve *can* be solved by other Corruflex Joints.

Drawings 1 & 2 at left show accordion-like movement as the Basic Single Joint opens and closes to absorb axial movement. In Drawings 3 & 4, note that maximum lateral deflection and maximum angular rotation are obtained when joint is in median position. ADSCO can supply complete tabular data on the maximum amount of allowable lateral and angular movement either side of center line. Under certain conditions, such as the addition of extra corrugations, the Basic Single Joint can be used to absorb combined axial and lateral or combined axial and angular motions.

For assistance in laying out piping systems, a cordial invitation is extended to you to consult ADSCO's engineering staff. Phone your ADSCO representative about this service or write the factory direct.


A. Straight axial motion... basic single joint
B. Combined axial and angular motion . . . two single joints with tie rods
C. Lateral (parallel offset) motion... basic single joint
A
B
C
Anchor
Anchor

ADSCO ENGINEERED PRODUCTS

EXPANSION JOINTS • HEAT EXCHANGERS • STEAM TRAPS • STRAINERS • SEPARATORS • METERS

AMERICAN DISTRICT STEAM COMPANY, INC.

GENERAL OFFICES
NORTH TONAWANDA, NEW YORK
PLANTS: NORTH TONAWANDA, N. Y., AND RICHMOND, CALIF.

What the

BIG TRUTH*

and

KEWANEE reserve plus rating

mean to the engineer . . .

■ Once in a great, great while an industry announcement has significance far beyond the usual. We at Kewanee-Ross believe the Big Truth about boilers and Kewanee Reserve Plus rating to be one of the most important precepts of business we ever presented.

Kewanee Reserve Plus rating *guarantees* dependability, flexibility, higher efficiency, lower costs, longer boiler life because it means "cruising speed" operation. So when you consider boilers, remember the Big Truth . . . ***"*the only safe way to select boilers is on nominal capacity to operate at 'cruising speed'."***

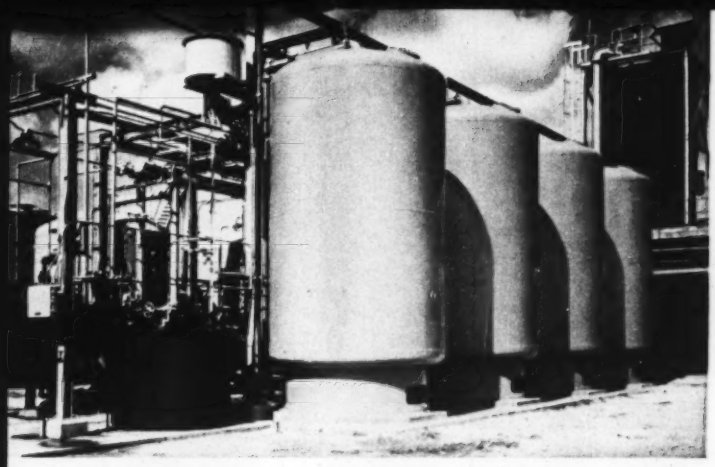
Kewanee Reserve Plus means boiler selection is made with confidence, guesswork is eliminated . . . the most economically sound expenditure is guaranteed . . . protection against emergencies and fluctuating loads, provision for expansion are provided . . . lower boiler maintenance and lower operating costs are assured.

M-800 Series

Write for **FREE** booklet on how to save thousands of dollars on boilers

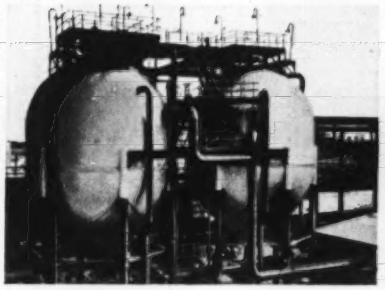
You can count on* KEWANEE *engineering

KEWANEE-ROSS CORPORATION • KEWANEE, ILLINOIS
Division of American Radiator & Standard Sanitary Corporation
Serving home and industry **• American-Standard • American Blower Church Seats & Wall Tile • Detroit Controls • Kewanee Boilers Ross Exchangers • Sunbeam Air Conditioners**



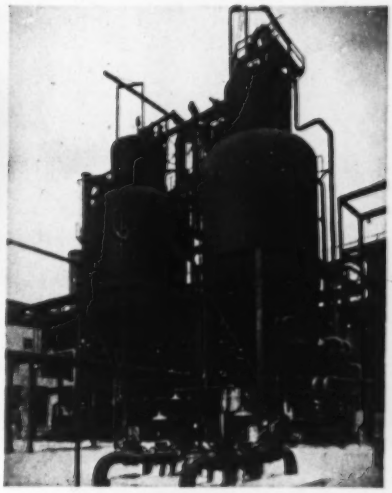
Automatic Demineralization and Silica Removal. *Permutit Ion Exchangers deliver the equivalent of distilled water at far less cost. Eliminate makeup shortages . . . operate independently of changes in turbine load. Fully automatic operation insures precision performance.*

WHICH Permutit Process will solve YOUR water problem?



Sludge-Blanket Hot Lime-Soda Softener *reduces hardness . . . silica . . . alkalinity and turbidity. Fully utilizes Permutit sludge-blanket principle to improve performance.*

Precipitator *clarifies and softens cold water. Uses less space, time and chemicals than previous designs. Removes hardness, turbidity, color, iron, manganese. Reduces silica, alkalinity.*



Deaerating Heater *removes troublesome oxygen and CO_2. Prevents corrosion and pitting of feed lines, stage heaters, economizers and boilers at high temperatures. Steam is used twice . . . deaerates water completely.*

Your Permutit sales engineer can help you decide . . .

Making the wisest choice requires time-consuming consideration of all types of equipment, ion exchange materials, controls, accessories. That's where Permutit can help you.

Permutit Sales Engineers work with a complete range of equipment—all types, all sizes. They do not have to compromise by trying to fit one specific process to your plant.

They can recommend with impartiality the one proper combination of equipment and materials that best solves your problem. For only Permutit manufactures both ion exchange resins and all types of water conditioning equipment.

This results in better performance at lower operating cost . . . undivided responsibility for the complete plant . . . plus savings of time and money in planning and specification.

For aid in solving your water problem, write to The Permutit Company, Dept.ME4,330 West 42nd Street, New York 36, N. Y., or Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS FOR OVER FORTY YEARS

PERMUTIT®

"Old reliable" 21 in. sliding head floor drill stays accurate

with spindle on TIMKEN® bearings

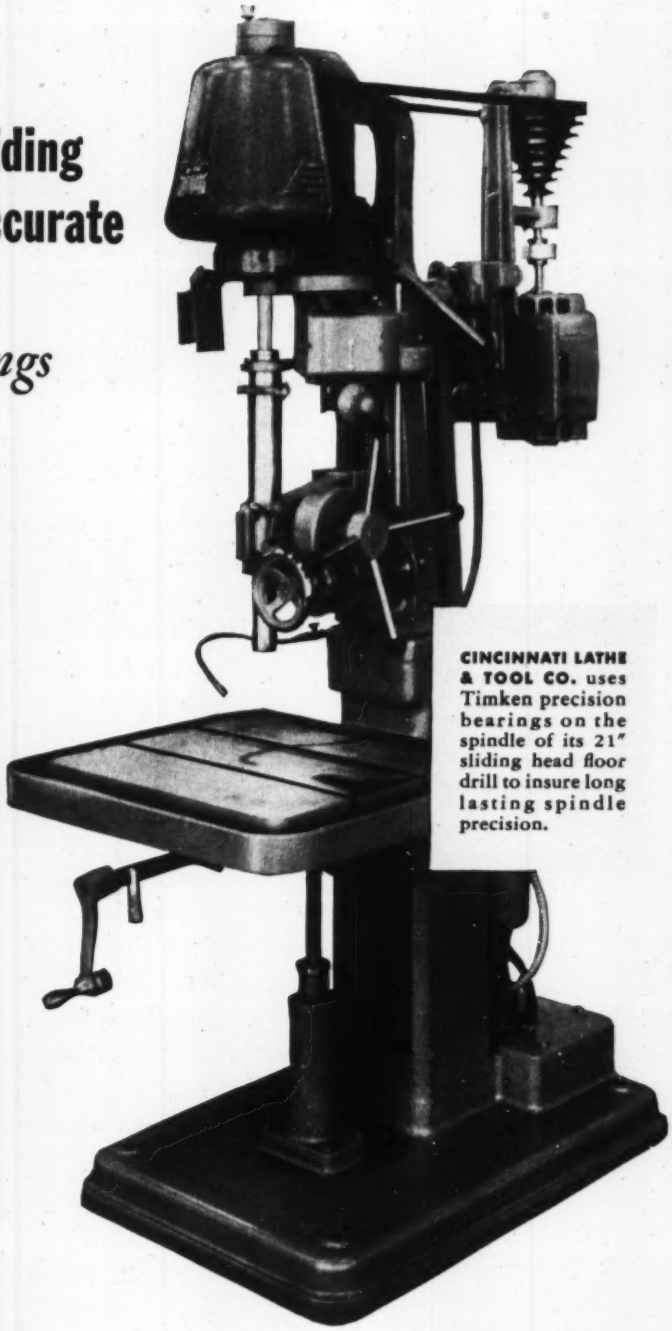
THE long-lasting precision of this Cincinnati 21″ sliding head floor drill has earned it the nickname "Old Reliable". One reason for this precision: the spindle is mounted on Timken® tapered roller bearings which are supported in an accurately ground and graduated quill. Two tapered roller bearings support the quill and two support the spindle pulley.

Timken precision bearings are especially designed for spindle applications. Run-out tolerances can be held to a maximum of 75 millionths of an inch. Due to their tapered construction, Timken bearings take both radial and thrust loads in any combinations, hold spindle rigid, permit pre-loading to any desired degree to prevent chatter.

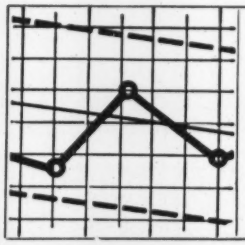
Because of line contact between rollers and races, Timken bearings provide adequate capacity for any tool load. And spindle accuracy can always be maintained because Timken precision bearings are adjustable.

Timken bearings have contributed to the development of precision machine tools for over 25 years. To get longer life with minimum maintenance, buy or build machine tools that are Timken bearing equipped. Always look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



CINCINNATI LATHE & TOOL CO. uses Timken precision bearings on the spindle of its 21″ sliding head floor drill to insure long lasting spindle precision.



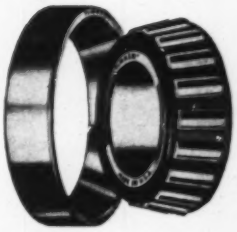
STATISTICAL QUALITY CONTROL

To insure uniform high quality and closer tolerances, the Timken Company uses statistical quality control. With it, tolerance deviations are plotted graphically. It's one of industry's newest, most scientific methods of improving product uniformity.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ◯ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◯ AND THRUST →◯← LOADS OR ANY COMBINATION →✳←